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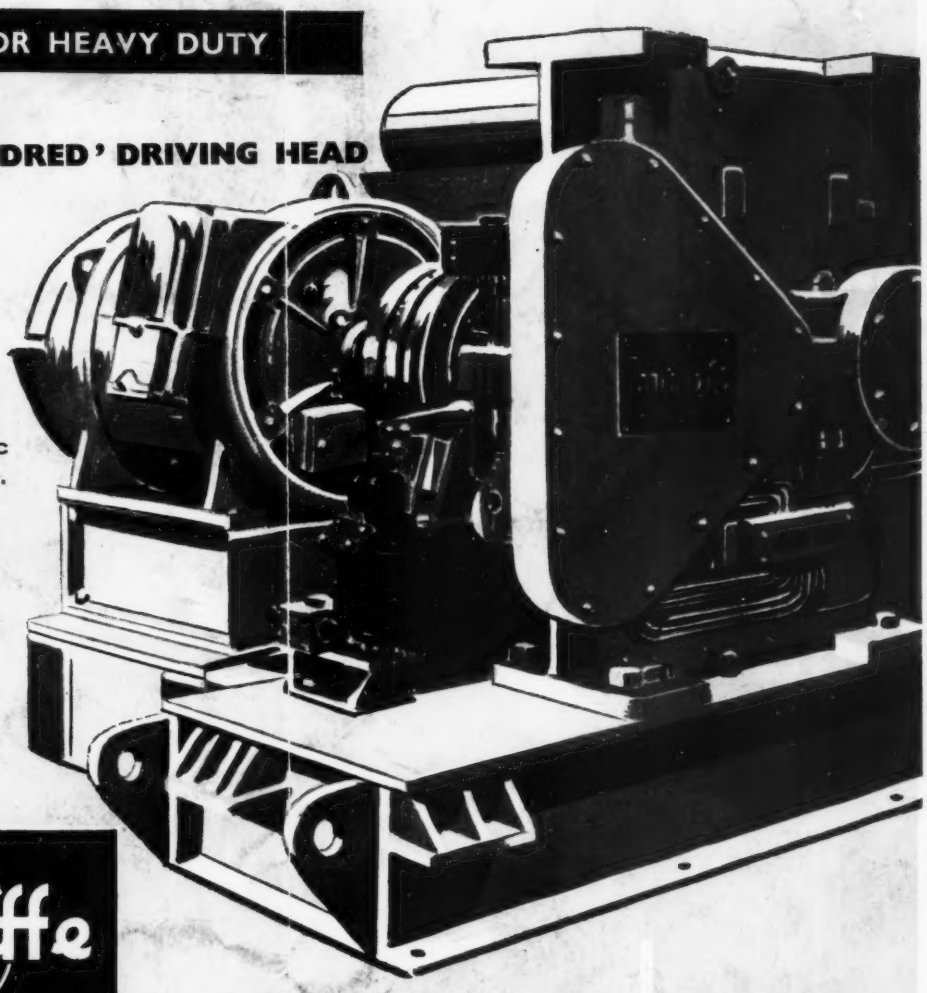

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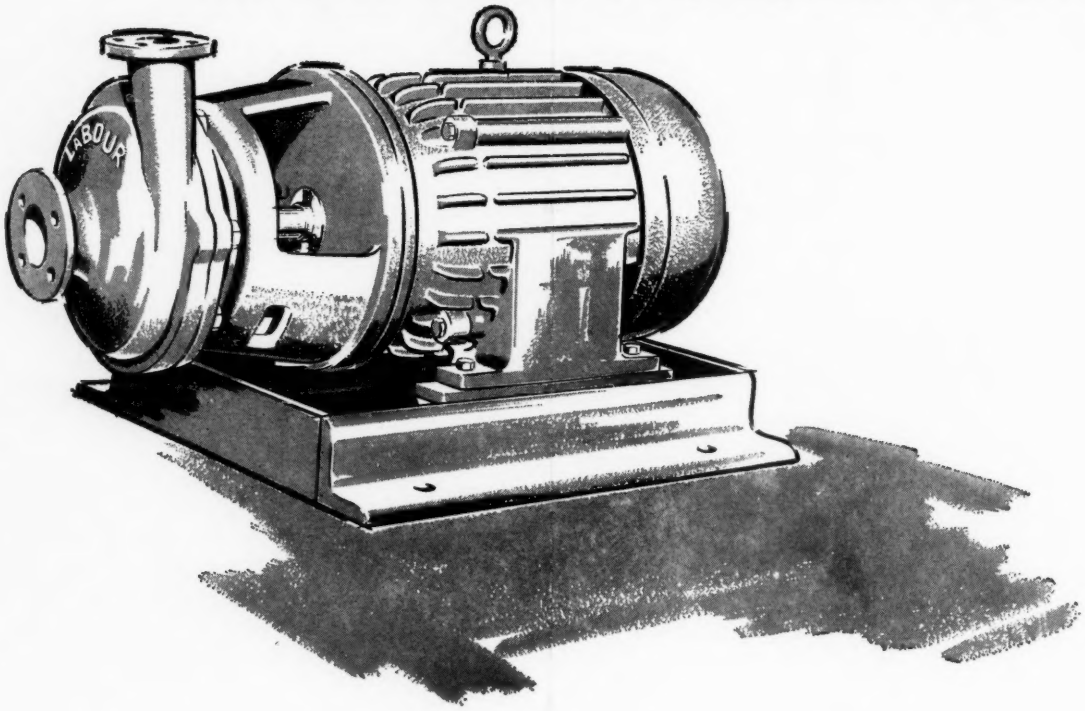

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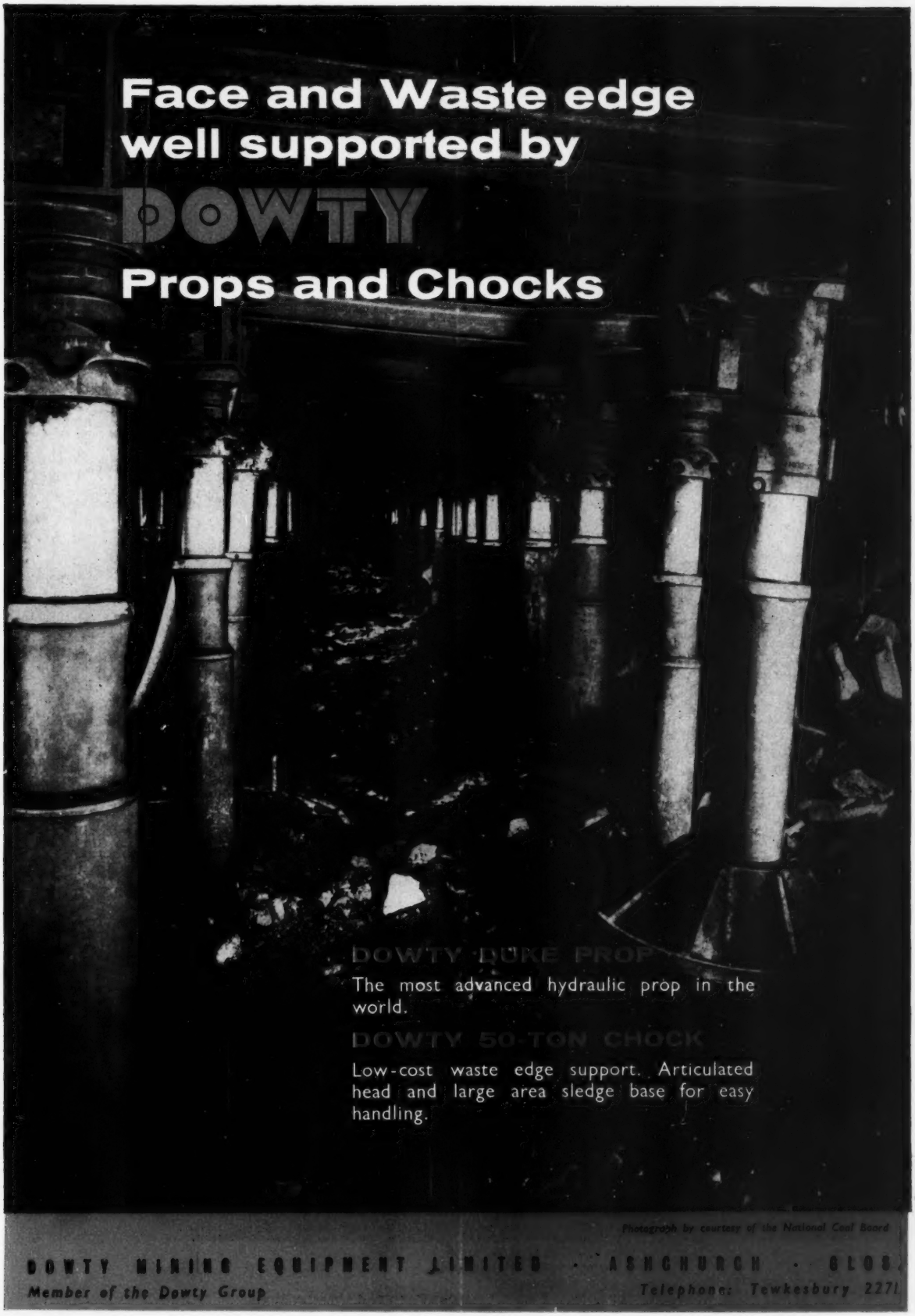
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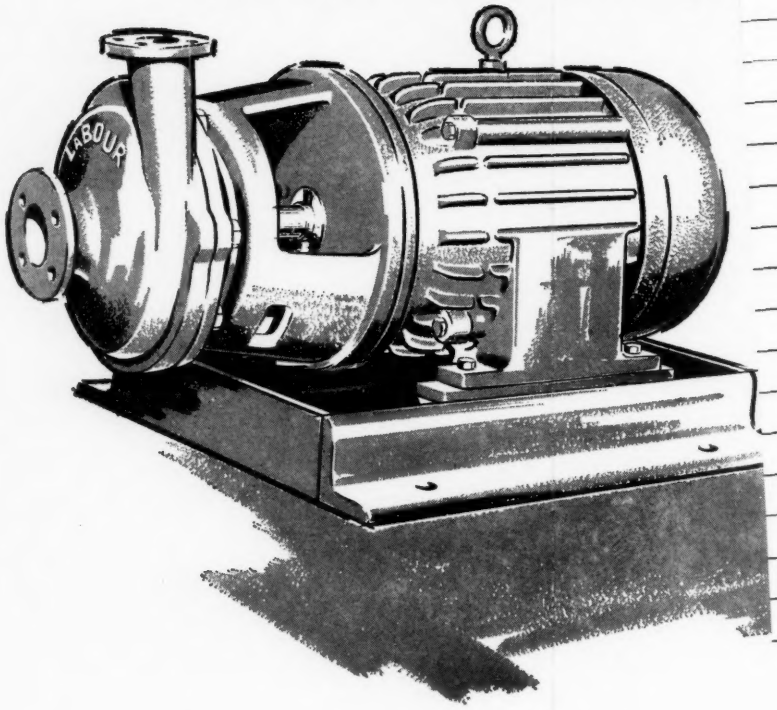

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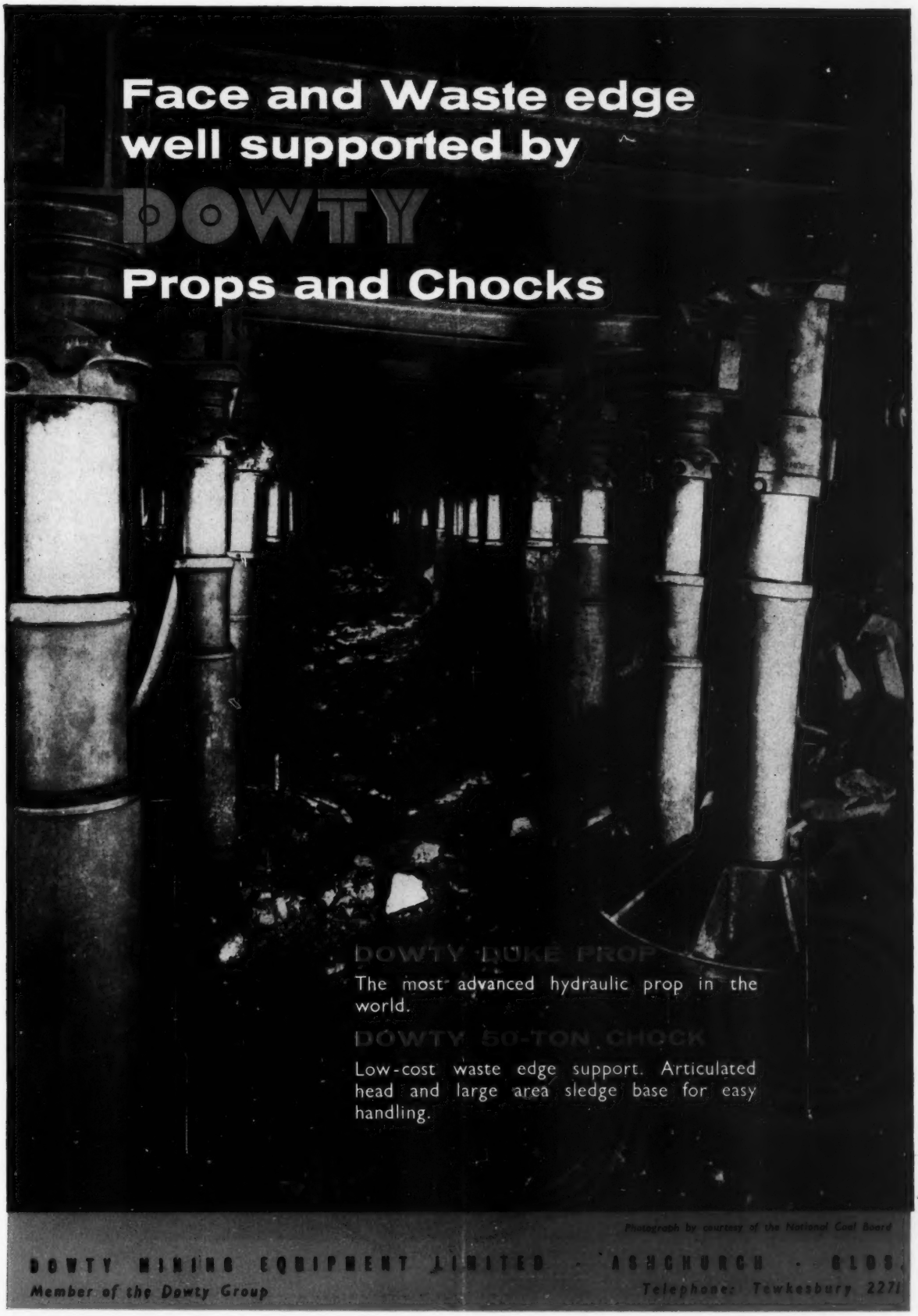
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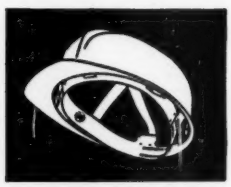

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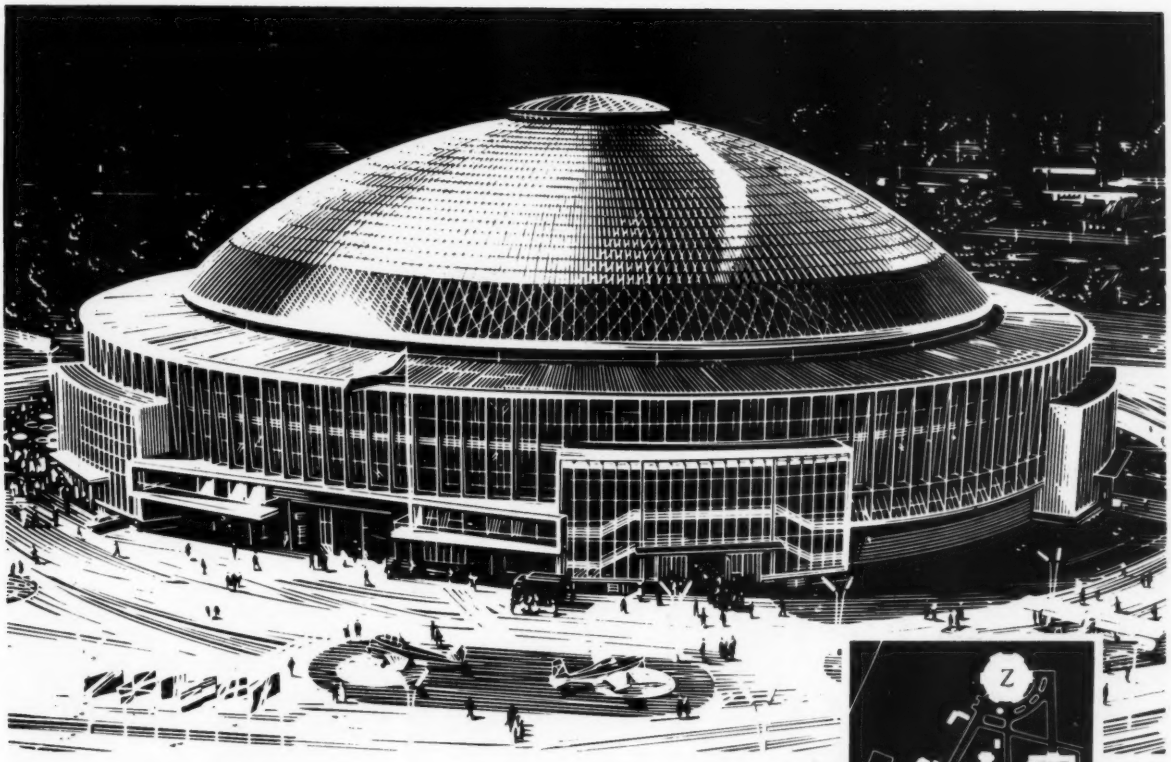

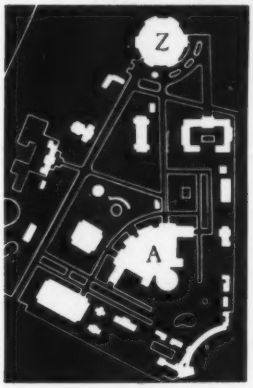

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The Mining Journal

London, August 19, 1960

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Cutting the Cost of Making Aluminium

ALTHOUGH the extremely rapid progress of the aluminium industry ranks among the outstanding industrial achievements of the present century, the rate at which growth can be expanded has been limited by a number of restrictive factors inherent in existing methods of producing the primary metal.

In the first place, aluminium is never found free in nature, but is always combined chemically with other elements, from which it cannot readily be extracted in metallic form. The first stage is a mechanical and chemical treatment of bauxite, which transforms it into alumina. Approximately two tons of bauxite are needed to produce one ton of alumina, and because of the long chemical process involved, it is not practical to extract the alumina unless a fairly large proportion is present in the ore. The alumina has then to be broken down into pure aluminium and oxygen by salt bath electrolysis. Two tons of alumina are needed for one of aluminium, the ratio of bauxite to aluminium being thus approximately 4 : 1. A very large amount of electricity, ranging as a rule from 18,000 to 20,000 kWh. per ton of aluminium, is required for the electrolytic process. Electricity is therefore the determining factor in aluminium production, and reduction plants are located where abundant low cost power is available.

For these various reasons the capital cost per ton of aluminium to be produced is high. The U.N. Economic and Social Council, in a report published in February, 1954, estimated it to be more than ten times as great as the capital cost per ton of steel. Moreover, according to the same report, it takes three to four years to build a fully integrated steelworks with a capacity of 1,000,000 tons, but almost twice as long to build a similar integrated aluminium plant. Then again, aluminium smelting, to be economic, must be done on an increasing scale in countries with rich but underdeveloped hydro power resources far away from the main consuming centres.

Tremendous interest has therefore been aroused by the "basically new" aluminium-making process to be used by Aluminium Ltd. at a $4,000,000 plant to be built at Arvida, Quebec (*The Mining Journal*, August 5, 1960, p. 155). Designed as an experimental unit, the new facilities are to have a capacity of 6,000-8,000 tons a year.

No details of the process have been disclosed. In making the announcement, however, Mr. Nathanael V. Davis, President of Aluminium Ltd., stated that bauxite of roughly similar grade to that used by the conventional process would be employed, and that the amount of power required would not be appreciably reduced He said, however, that the process gave promise of substantial saving in other elements of production costs and on the capital cost per ton of aluminium.

Unofficial reports from Montreal, entirely unconfirmed by the company, suggest that the new process will convert bauxite directly into aluminium without the intermediate alumina stage. If so—and it is difficult to see what other conclusion could be drawn from Mr. Davis's statement—this would represent the first revolutionary development in aluminium production since the perfection of the Bayer process.

A view which has been widely put forward is that the process is based on work originally carried out by Dr. P. Gross at the Fulmer Research Institute, Stoke Poges. Jointly sponsored by Aluminium Laboratories Ltd. and International Alloys, Ltd., this programme was started some years ago and was referred to in an article on the Institute published in our issue of October 10, 1952.

The method on which Dr. Gross was then working was a process of "catalytic distillation", based on the formation of an unstable subhalide, which has since been patented in all leading industrial countries. From theoretical considerations Dr. Gross deduced the existence of a monochloride of aluminium and subsequently he went on to prove that pure aluminium could be produced by alternating the formation on heating and decomposition on cooling. Briefly, aluminium trichloride is produced by heating bauxite in an electric arc furnace in the presence of chlorine gas, this being followed by catalytic distillation of the aluminium trichloride to give metal. An experimental plant for catalytic vacuum distillation has been in operation for Fulmer for several years, producing aluminium of about 99.7 per cent purity. By the summer of 1959 Dr. Gross was producing lumps of high grade aluminium weighing perhaps 1-2 lb. each in laboratory equipment.

Whatever the nature of the process, it seems evident that the board of Aluminium Ltd. would scarcely have sanctioned the expenditure of such a large sum as $4,000,000 on a pilot plant without being confident that the method would be commercially successful. If the company's expectations are realized, the effects on the industry will obviously be far-reaching, but the short term impact will no doubt be cushioned by the heavy cost of existing equipment which could scarcely be jettisoned overnight. It seems reasonable to assume that, for economic reasons, the new type of plant would be introduced gradually as new capacity was installed and worn or obsolescent equipment replaced.

Much effort has also been devoted by other primary producers, as well as by government bodies, to the development of new or improved processes for making aluminium. A newly developed process will be tested in a pilot plant which is to be opened by the two French producers, Péchiney and Ugine, in the last three months of 1962. The plant will have an annual capacity of between 3,000 and 5,000 tonnes. Both companies have been conducting experiments in the field over a period of about ten years and the process is reported to be covered by patents issued in several countries. Its nature has not been disclosed.

According to *Tass*, a basically new method of processing bauxite, which will reduce both the cost of the plant and that of the finished metal, is to be installed by the Soviet Union at one of its biggest aluminium plants which is being constructed in north west Kazakhstan. It has also been reported (by the *Engineering and Mining Journal*) that Russia had developed a new extraction process to obtain alumina from nepthelline, which has about 50-67 per cent of the alumina content of bauxite and is more difficult to process. In the new extraction process, soda, ash, potash and cement are said to be obtained as by-products.

In view of the dependence of the U.S. aluminium industry on imported supplies of high-grade bauxite, the Bureau of Mines is understandably devoting much effort to research on bauxite, alumina and aluminium, with emphasis on developing economic processes for producing aluminium from low grade domestic materials.

In June next year a U.S. concern, the North American Coal Company, expects to bring into operation a $1,000,000 plant at Powhatan Point, Ohio, for the production of aluminium ore from a so-called "GOB" pile of waste material that exists in abundance at its coal mines. The company has a method, developed after four years of research with the Strategic Materials Corporation, that produces aluminium sulphate from these waste materials. Decomposed aluminium sulphate becomes alumina. According to the president, Mr. Henry Schmidt, the company might eventually become a primary aluminium producer.

It can scarcely be doubted that, as time goes on, the development of new processes capable of producing aluminium more cheaply and conveniently, or of utilizing raw materials of lower grade, will lead to the gradual disappearance of the obstacles which have hitherto shaped the pattern of aluminium's growth, thereby placing the industry in a a still more favourable position to compete with other metals in its ever widening fields of application.

COPPER IN CHILE'S RECONSTRUCTION PLANS

It was reported in June that Kennecott and Anaconda were being urged by President Jorge Alessandri of Chile to increase their investment in Chile by $250,000,000 in the next four years in order to help the country to recover from the earthquakes. The president had rejected a proposal by the Communists that heavier taxes be imposed on the U.S. Copper companies to help finance rehabilitation Officials of the two companies have indicated that their companies are planning expansion of their copper mining facilities in Chile by a total far above the figure suggested by Sr. Alessandri.

The Chilean Government and the U.S. companies are reported to be still negotiating over a proposed investment of $400,000,000 to double output to 1,000,000 tons. According to Senor Robert Vergara, Chile's Finance Minister, Kennecott plans to invest $200,000,000 and Anaconda and Cerro de Pasco $100,000,000 each. These investments are conditional on Parliamentary approval of a Bill giving the companies fresh taxation concessions, or at least freezing current rates, for 20 years.

The Senate joint committees of Finance, Economy and Public Works have adopted a Bill which lays down plans for reconstruction of the ravaged zone. One clause included in the Bill provides that American copper companies subscribed to the government loans equal to 20 per cent of their annual profits taken out of the country during the next five years. The loans would be of ten years' duration and would bear no interest. Any investments undertaken by such companies aimed at modernizing or enlarging plants would be deducted from the 20 per cent. Plans for such investments would be submitted to the Copper Department for approval.

Another clause provides that American copper companies would reimburse to the government, within 90 days after the Bill became law, the extra income they obtained from the currency exchange rate modification enforced by the government in December, 1958. These amounts would be determined by the government.

Under Chilean law the Bill has to be approved by both branches of the Congress. The reactions of the companies to the proposed measures have not been disclosed.

In January-June this year Chile's copper output amounted to 272,169 tonnes, of which the large mining companies accounted for 247,755 tonnes.

The immediate production outlook is, of course, dependent on a peaceful settlement of the wage negotiations at Anaconda's Chuquicamata mine, where the present labour contract expires on September 30. According to Anaconda, the workers' present demands, including a 70 per cent increase of basic salaries and wages plus fringe benefits, are unjustified and would mean a new disbursement of about $28,500,000 per year, which the company is unable to stand. In view of the wide gap separating the two parties, prospects for averting a strike can scarcely be regarded as favourable.

DIVISIONAL COMPUTER CENTRE

During the past few years the National Coal Board have been experimenting with the application of electronic data processes to clerical work such as the calculation of wages and labour costs, the preparation of invoices and sales statistics.

In the West Midlands Division there are two installations. At Chatterley Whitfield, in the North Staffordshire coalfield, there is an I.B.M. 650 computer dealing with the calculation of approximately 23,000 wages, both piecework and daywork, and the payroll for everyone employed in the area. At Dudley, there is an I.B.M. 604 calculator which prepares invoices for sales of coal for all customers other than retail trade.

The experiments with electronic data processing have been very successful. There has been a much quicker preparation of costs and statistics and substantial administrative economies have resulted. The Board have, therefore, decided to extend data processing to the other areas and also to other accounting procedures.

Eventually, there will be one large centrally situated installation at Bridgtown, Cannock, where a specially designed building will be erected for housing computers and ancillary machines. Particular attention will be paid to air conditioning and sound proofing. In addition to the computer block, there will be an administrative wing. In all, approximately 180 people will be employed at the centre. Plans for the building are well advanced and the computer block should be ready for occupation in June, 1961.

In August, 1961, the installation at Chatterley Whitfield will be transferred to Bridgtown and towards the end of that year the work done on the installation at Dudley will also be transferred. The wages and salaries of over 50,000 employees will be processed at Bridgtown, as will the sales of the total Divisional output of coal.

The Board intend that wages, salaries and sales—with their associated costs and statistics—will be processed for all areas in the Division before there is a further extension to other accounting procedures, such as stores. This stage will take two or three years to complete.

Much work is necessary before the system can be extended and staff are at present being trained. The extension of the system will involve considerable movement of staff and there will be transfers to Bridgtown from all areas of the Division. The introduction of electronic data processing means adoption of new techniques; but the experience of the Board has been, in North Staffordshire, that staff readily assimilate new ideas and quickly adapt themselves to them.

All the staff engaged on the two existing installations, including the computer programmers, have been recruited from within the Board. The Board are planning similarly to recruit all staff for the Bridgtown installation from their present employees, who will be trained in the new techniques.

As the plans have been developed there has been full consultation with the National Union of Mineworkers and the Unions representing staff.

SOUTH AFRICA PREPARES FOR THE CONGRESS

Preparations are in full swing for the Seventh Commonwealth Mining and Metallurgical Congress which will be held in the Union and the Federation in April and May next year, writes our South African correspondent. President of the Congress will be Mr. C. S. McLean, General Mining and Finance Corporation.

Study of the final programme clearly indicates that it has the makings of the greatest of these meetings ever held. At the end of it, there will be little that members will not know about mining in Southern Africa and they will have had the opportunity to see a great part of both countries, apart from the purely mining areas.

Comparing this programme with that of 30 years ago, when the first Congress was held in South Africa, one cannot but be struck by the tremendous advance that has taken place in mining. On that occasion, many of the papers dealt with minutiae of mining practice, and to fill in the bill, papers were read on mining developments in other Commonwealth countries.

This time some 90 papers will be presented dealing with broad principles such as shaft sinking, tunnelling, water problems and the like. None of these will be anything like exhaustive, but members will have plenty of opportunities to see South African techniques in operation. For example, though not mentioned in the programme, it would not be in the least surprising if a new world shaft sinking record—this time around the 1,500 ft. mark—turns up while the Congress is in session.

As for the tour side, the congress manager, Mr. H. Husted, has worked out a series that even makes the mouths of travelled South Africans water. A couple of these tours involve places in South West Africa which most people in Johannesburg can only dream about visiting. A lot of the travel will be done in luxury trains, which will also act as mobile hotels. With the co-operation of the government and the Railways Administration, the tours will be remarkably cheap by any standards. All-in cost by rail will probably work at around £10 a day; air trips at £15 a day; and those by motor coach £1 and £3 a day. As for the individual mines to be visited, they are laying themselves out to provide delegates with the time of their lives. The arrangements covering the Central African Federation where the Congress will take place during its last two weeks will be along exactly the same lines.

It will be recalled that the papers to be presented at the Congress were listed in our issue of July 8, 1960. The tours arranged for delegates are as follows:

(1) The Witwatersrand gold mines, April 13; (2) Natal and Orange Free State, April 14, 15 and 16; (3) O.F.S. Gold Field, April 16, 17, 18; (4) Vereeniging, April 19; (5) Thabazimbi, April 19; (6) Kimberley, Koegas, Postmasburg, Tsumeb, South West Africa, and Etosha Pan Game Reserve, April 19-23; (6a) Koegas and Postmasburg, Kimberley, Oranjemund and South West Africa, April 19-23; (7) Klerksdorp, April 19; (8) Cape Town, and the Western Province.

Bucket Wheel Excavators in G

GERMANY gets most of her electric power from lignite so that the open pit lignite mines are of supreme importance to the German economy. The mines are too deep and the coal too thick to dump the overburden directly behind the mining operation as in American middle Western strip coalfields. Mines are developed on the multiple bench system and, in that respect, are more similar to an iron ore or copper pit than to strip coal operations.

One of the most recent American wheel excavators, a 3,500 yd. per hour machine designed specifically for strip mining, dumps the spoil directly behind the excavator by means of a long stacker boom which pivots on a common base with the digging ladder. The German machines have separate pivot points and swings for the ladder and tail boom, because the tail has to discharge into a motionless railroad car or conveyor hopper while the digging end is constantly swinging.

The Germans are exporting considerable numbers of them and they are in use in lignite mines in Italy, Yugoslavia, India, Greece, Australia and Indonesia, in diamond fields and copper pits in Africa and in the bauxite deposits of Surinam.

For a given output, the size and weight of a wheel varies considerably with the job it must do. Hourly capacity per ton of weight means nothing unless other factors are taken into consideration, such as length of reach and digging height. A typical medium sized German excavator has a 20 ft. dia. wheel with eight half-yd. buckets discharging at 60 buckets per min. and has a service weight of 520 tons. It has a reach of 40 ft. above the pit floor and 16 ft. below, with a practical output of about 1,300 bank yd. per hour when used in conjunction with a belt conveyor system. The practical output is determined as much by the conditions of the job as by the machine itself. In general, a well designed conveyor set-up will permit a 25 per cent increase in output over a train haulage simply because the machine can run a greater percentage of the time.

Advantages of the Wheel Excavator

Advantages of the wheel excavator in strip coal mining have already been proved in the U.S., the most important being that it makes a natural combination with conveyor belt haulage. It slices up the dirt in small pieces and delivers material continuously to the belt.

The Germans have ideal material in which to use bucket wheel excavators; overburden is mainly fine and sandy—easy digging. For many years the wheel excavator was considered to be applicable only in lignite, but the gap between what these machines will do and what a shovel will do is narrowing. A properly designed bucket excavator will cut hard shale that would normally be blasted for shovel stripping and development of the chain-backed bucket has made its use possible in wet, sticky clay.

Consensus of opinion is that the bucket wheel excavator should stay away from hard rock, except for seams up to a foot thick imbedded in soft material. However, the cutting force on bucket teeth is constantly being increased by the use of heavier drive motors and improved design and, if progress in the next five years equals that of the last five years, the wheel excavator will be doing many jobs considered impossible today.

The use of conveyor belts for high capacity transportation of ore and waste in German open pits started less than ten years ago, but the progress has been tremendous in that short time. One mine with a completely portable system for handling overburden uses steel cord belts with a capacity of 15,000 tons per hr. running 1,000 f.p.m. The operators have already moved 60,000,000 tons on this belt and expect to get over 200,000,000 tons on it before it wears out.

Two important factors in German conveyor-equipped pits are that the belts run fast and the conveyors are extremely flexible and easy to move. Speeds on long conveyor runs are from 800 to 1,200 f.p.m. and on stackers the speeds go up to 1,600 f.p.m. This compares with American present practice of running belts 500 to 600 f.p.m., although in the last three years a few have been put into operation at 800. German engineers and operators say the limit has not been reached yet and that the limiting factor is not the belt itself but the way material rides on it.

For a given tonnage a fast belt permits a less expensive drive, a narrower belt width, and a belt with a lower tension rating. It saves in weight and structure and in general first cost is less. On many applications, such as on a long suspended stacker boom, there is no other economical alternative. In a conveyor-equipped open pit mine, with long distances to travel and high tonnages to handle, high speed is almost a necessity in order to keep the first cost down.

Transfer Point

The transfer point is the heart of the conveyor system. No effort should be spared to get, as near perfect as possible, the transfer of material from one belt to another. To achieve this, three factors are of prime importance: (1) getting the free fall as low as possible; (2) loading the belt on centre and in the direction of travel; and (3) keeping skirts and chuting from rubbing on the belt.

Lowering the free fall can be done in several ways. First, get the head pulley of the feeding belt as close to the following belt as possible. On many of the new portable drives in Germany the head pulley is small and runs at idle, with no drive motor. The drives are on snub pulleys to the rear of the head section which permits the head pulley to project out in front of the main structure 15 or 20 ft. with no interfering supports. The cantilevered projection is on a pin joint and with an adjustable brace the head pulley can be raised or lowered to get exactly the transfer wanted.

If this is not feasible, a short transfer belt is put in between to break the fall and to give the proper velocity and direction for a good feed. If the material is lumpy or rocky, and impact damage might be severe, high speed roller grizzlies are sometimes used, which let fines fall through and provide a cushion for rocks which follow.

Loading characteristics of a stream of moving material varies with the quantity on the belt, and the Germans almost always put an adjustable deflector or splash plate in front of the head pulley to make the dirt fall vertically to a precise point on the next belt or feeder. This is absolutely essential on angular transfer points.

German Mining

Mr. R. E. Kendall, assistant mine superintendent, U.S. Borax and Chemical Corporation, has reviewed German methods of dirt moving, and compared them with current practice in America, in this article, abstracted from " Mining Congress Journal "

One operator in Bavaria has worked out an ingenious scheme for eliminating skirt wear. At the transfer point he put in extra troughing idlers and got the belt into a deep 50 deg. trough. With a trough this steep chute skirts can be kept over an inch away from the belt without getting spillage or scuffing.

The only ground preparation required for this type of conveyor is a graded roadway. Vertical control is not too important as the conveyor runs can follow, to a great extent, the natural irregularities of the ground. Horizontal control for line is provided by an offset stake line run in with a transit. Semi-permanent conveyors are set on ties only, while the shiftable conveyors in the pit and at the dump are provided with a set of 90 lb. railroad rails running on the ties on either side of the conveyor structure. The rails serve a double purpose by providing a track for movable transfer stations and tripper cars and a means for shifting the conveyor.

The conveyor is shifted by a tractor, usually rubber-tyred, with a side boom attachment. After a roller device is attached to one rail, the rail is picked up slightly off the ground and pulled toward the tractor. As the tractor moves down the belt run parallel to the conveyor at speeds up to 12 m.p.h., the rail, and consequently the whole structure, is warped in an undulating motion. When the tractor reaches the end of the conveyor it simply reverses and repeats the operation in the opposite direction. Each pass shifts the whole conveyor from three to six ft. and the process is repeated until the desired shift is completed. A complete conveyor 2,000 ft. long can be shifted 200 to 300 ft. in eight hours.

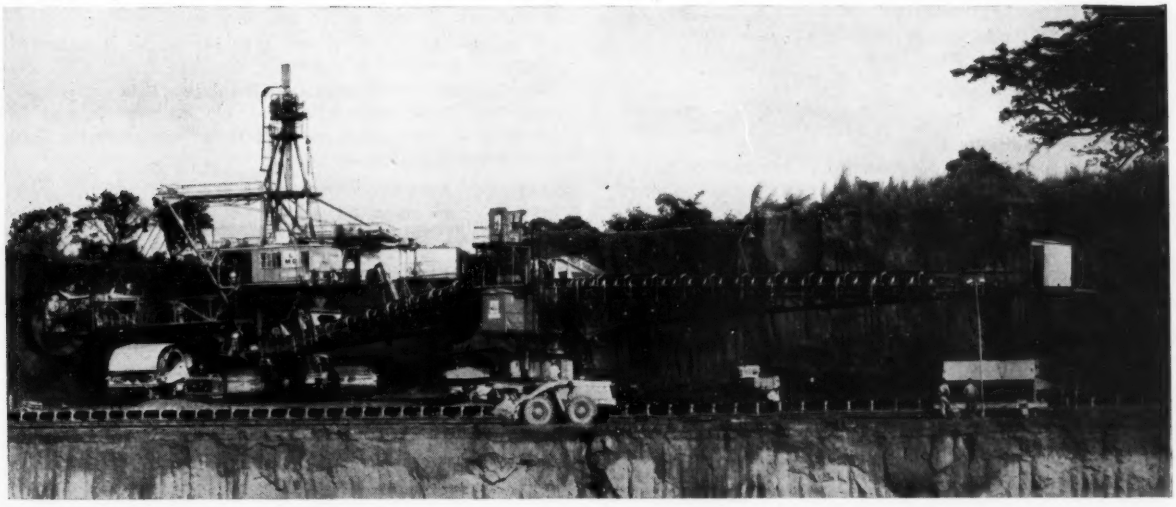
The drive and tail sections are also portable and they are mounted on sheet steel sleds. The very largest drive stations are on crawlers. The only stress on a conveyor drive is in the direction of belt pull, and this is taken care of by anchored cables, which are tightened up on geared or ratchet hand-hoists. In the constantly shifting belts at the pit face, cable holddowns at the head and tail also provide tension for the belt.

The Germans use 30 deg. troughing idlers instead of 20 deg. which are standard in the United States. They say the 30 deg. idler is definitely superior for high tonnage belts, since it allows a greater cross sectional load and helps keep the belt properly trained. Return idlers are of many types from plain steel to spiral wire to rubber disc but most operators prefer the rubber disc because wet material does not build up on them.

The steel cord belt is finding more use in Germany than in the U.S. One mine has a single 48 in. belt run 6,000 ft. long with belting of steel cord construction to take care of the extremely high tension resulting from the 1,300 h.p. drive. The operator who has the 15,000 t.p.h. conveyor system uses steel cord belts with no fabric in them whatever—as a fabric cord belt of the same strength would be so thick it would not be able to bend around anything but a giant head pulley.

A conveyor equipped pit is not complete without a way to get rid of waste. The German pits are too deep to backfill directly, as in strip mines, and waste hauls run from a mile up to three miles. At a new lignite pit being developed in the Rhineland, 90,000,000 tons will have to be dumped above ground before there is room in the pit for backfill.

Although there are quite a few rail stackers operating, most of the new machines are crawler-mounted. The dump is just the reverse of the pit face. The dump conveyor is on ties with rails for shifting and a self-powered belt tripper rides on the rails. The stacker tail boom picks up the stream of dirt from the tripper. The highest belt speeds are found on stacker booms, to minimize weight and give the stacker extra reach by lengthening the throw. Because the material is wet and slides easily, booms are long so that the angle of inclination can be kept at a minimum.



German wheel excavator and mobile transfer belt operating on the top bench at the start of the east to west cut in the Nchanga open pit, Northern Rhodesia

Notes on Some Modern Distillation Processes

By C. C. DOWNIE

PROCEDURES connected with the distillation of metals represent one branch of pyrometallurgy which at times appears to have been given somewhat scant attention. For example, the oil-fired individual distillation retort, although not normally economical by itself in so far as ordinary smelting of zinc ores is concerned, has proved a useful adjunct in other activities. Unlike the battery of retorts in the regular smeltery, this unit is provided with a lengthy condensing line to the receiver, which collects zinc that has been distilled over. (The same type of unit is employed for concentrating cadmium from zinc fume.) In some respects this resembles the condensing line connected with acid plants, but a heat-resisting refractory is used to replace the acid-resisting glazed ware.

Certain small metal refiners use them for reclaiming zinc which would otherwise be lost as fume from reverberatory or other refining hearths. As an illustration of this, the familiar de-silverizing of lead using repeated additions of zinc means that skimmings are taken off frequently. This is done so that the small successive additions may not amount to too considerable a tonnage. For example, in refining 5 tons of lead containing silver, additions of 40 lb. of zinc were made 6 or 7 times, whereby a total of some 2½ cwt. of zinc was consumed. This might at first sight indicate an economical measure, in view of the fact that the silver content could be reduced from several hundred ounces of silver per ton, down to little more than an ounce per ton. Over a period, the silver contents ranged from 0.5 ounce to 5 ounces per ton.

The other aspects of the process are that the time occupied could reach as much as 3 days, with frequent attention from two men, and which included the final steaming treatment. What zinc was used was entirely lost, as the skimmings, which in that length of time had accumulated to large proportions, had to be returned to one or other of the smelting furnaces, and ultimately dissipated as fume.

Efforts were made to discriminate between the actual zinc skimmings, and the final more or less purely lead skimmings acquired mainly during the steaming treatment, as the former were rich in silver and were passed to refining furnaces, whereas the latter lead skimmings only contained sufficient silver to justify charging into small blast-furnaces. The laborious zincing would not have materialized had it been possible to use much more zinc, but such a system could not be considered, since all zinc was to be lost ultimately in any case.

Larger Zinc Additions

Provided with the individual oil-fired distillation layout, the process is then enabled to take advantage of using larger zinc additions, virtually irrespective of whether the silver contents are large or small. What zinc is used is reclaimed from the receiver for repeated use, while the time saving is quite considerable, and although there is always a loss sustained of zinc fume, the well controlled retort reduces this to a minimum, as distinct from where batteries of retorts are engaged. This work is, of course, assisted where relatively large consignments of zinc residues come to hand for de-silverizing, since zinc will be recovered as a by-product in any case, and is usually acquired for nothing.

Far from using 2½ cwt. zinc for 5 tons lead, or some 30 lb. per ton, more than 1 cwt. zinc per ton is used, which in its train means that silver is readily drawn up to the top sections of the mass for skimming off. This differs materially from early practice, where according to accounts only 13 lb. of zinc were added per ton of lead, and where initial additions were made to alloy largely with the gold, and which could reduce this to some 6 dwt. per ton.

In the modern precious metal refinery, even lavish additions of zinc are permissible, since other precious metals are also drawn into the zinc skimmings.

Although losses of zinc to the fume are understood to be under control, cases have been cited where as much as 15 per cent passed off as zinc oxide—otherwise the recovered zinc is refined, and returned for further de-silverizing work. As a rule, two of these individual oil-fired retorts are at hand, one of which is in more or less regular use. The difference in labour requirements alone, apart from repeated use of the same zinc, besides getting a rapid return of other precious metals, let alone silver, gives a measure of some of the advantages gained.

For some time this system was apparently utilized for a wide variety of argentiferous materials, since although some small amounts of antimony and copper may remain in the lead, in view of their superior affinity for zinc, they are taken off with the zincings. Where high antimony contents appear, zinc can remove about two-thirds of it, while all copper is removed, but the retort residues then become bulkier. Some early accounts of the Parkes process indicated efforts to reduce zinc consumption, and cut down ultimate steaming, where steam was introduced at from 22 lb. to 70 lb. per square inch pressure. Care was also taken that no back pressure of gas could cause explosions by the hydrogen formed.

On the one hand, submerged combustion was evidently tried out in place of steaming with a view to minimizing the production of lead oxides, but was not persevered with, while alternatively, high pressure steam did not evidently make any marked improvement. The amount of duplication entailed where lead is used as the basic picking up medium for silver and precious metals is worsened where no provision is made for distilling zinc. The only ameliorating circumstance is that this work is carried out on a very small scale with relatively little in the way of competition; otherwise such methods would have been abandoned a generation ago.

Electric Vacuum Distillation Furnaces

Distillation processes are seen from an entirely different aspect in connection with another form of residues, namely those recovered from white bearing metals, which contain zinc. They also include all kinds of turnings and sweepings from engineering shop floors, where brass and iron are accumulated, besides actual tin-lead-antimony materials. For many years, and in some cases to the present day, some smelters are unwilling to accept these materials when zinc is present. One large smelting concern went to the length of deducting two parts of tin for every unit of zinc

present, while consignments containing sulphur were not wanted. As the presence of zinc thus very materially reduces the market prices obtained, a unique form of furnace hailing from the Continent was applied to these classes of material. This comprised an electric vacuum distillation hearth, which had formerly been tried out for experimental purposes.

Zinc can be distilled in metallic condition, out of contact with air, by this means, but no additions of carbon are made here, and the process as it stands is only suitable for metallic charges. All tin, lead, antimony, and copper, and any little iron which may be present, remain intact in the retort residues. As the boiling points of tin, lead, and antimony are around 1,500 deg. C. whereas zinc is only some 918 deg. C., and without any means of oxidation in view of the vacuum, it is zinc alone which becomes dispelled. The vacuum does not require to be a powerful one, as is necessary with tantalum, which when in molten condition can absorb all kinds of gases, but has simply to be sufficient to offset oxidation. If this were not to be done, some of the oxidized tin, etc., could enter the distilled zinc in the enclosed receiver.

One of the original tantalum furnaces took advantage of a four-stage compressor (normally engaged for compressing work with rare gases) which was utilized to virtually eliminate every particle of air, and also during the heating process to take out what oxygen was exuded from the tantalum oxide. Where the four-stage compressor is applied, a king valve closes, as each stage is put into operation, and, in the case of tantalum, is opened again when melting gets under way, but this is superfluous with the vacuum zinc process. With the latter, distillation of zinc alone proceeds and passes to the receiver until the treatment is completed, when the vacuum is broken, and after suitably cooling to around 600 deg. C. the residual tin, lead, and antimony alloy is run into moulds. In the larger refineries, this in turn is subjected to aluminium treatment to remove the antimony - aluminium alloy, and the remainder cast into anode moulds and electro-refined to give electrolytic tin, and lead anode sludge.

Although vacuum distillation was known more than a generation ago, judging by the number of parcels of tin-bearing materials containing zinc from which deductions are made, the process has apparently only enjoyed limited application. The success of the process depends on the fact not only that the metals remain static as distinct from zinc under the influence of heat, but that any slight modicum of oxidation could be insufficient to impair the process. These oxides themselves likewise remain more or less static, but strange as it may appear, the only one with a tendency to volatilize is copper oxide, which is sometimes found in the zinc receiver.

Molybdenum Distillation

Distillation is seen in an entirely different light in connection with molybdenum, which, although melting at upwards of 2,400 deg. C., produces a volatile oxide. Thus although the tin, lead, antimony group are low-melting, their oxides are more or less static in the volatile sense, whereas the refractory molybdenum is the opposite, but high temperatures are necessary to disengage its oxide. As with galena, the molybdenum sulphide ores, or molybdenite itself, are roasted to oxide condition in Herreshoff multi-deck roasting furnaces, the temperatures are not allowed to reach 800 deg. C., and the oxide of molybdenum thereby remains intact.

The blue oxide, which is regarded as a combination of dioxide and trioxide, as its composition has not been definitely settled, becomes volatile at high temperatures, quoted at 1,200 deg. C. although still higher degrees are used to cause it to be distilled off completely. Briefly, unlike the ordinary zinc distillation retort, or the vacuum distillation retort, the material is deliberately given access to the greatest possible amount of oxidation while great heat is applied. The roasted mass is transferred to trays of carborundum, placed within a cylindrical hearth, one of the largest of which is of 10 tons capacity, accommodated on a revolving base.

Electric heat is applied from select resistance rods of 2 in. dia., which transmit their heat downwards on to the hearth, but these rods after some time require replacement, since when worn and eroded, they are liable to run up the pressure to some 250 volts. The door of the hearth is always kept open to allow free entrance of air, while a system of chains protects the hearth attendants from the great heat, and the sky - blue coloured oxide passes off continuously as a light flocculent powder.

As the various carborundum trays pass around the revolving hearth, they are subjected to stirring to expose different surfaces to this high temperature oxidation. The residue remaining in these trays is mainly composed of silica and slag, but it is important that no zinc be present in the original ore, since some of it, with what oxidation conditions abound, is liable to find its way into the blue oxide. The hot gases first pass to a cyclone collector, as drawn-in by a powerful fan, and from thence pass to a collecting tower, where the fine mass enters the compressing stage.

Although this oxide is understood to have a specific gravity of 4.4, its flocculent condition necessitates it being compressed by a hydraulic ram so that a moderate sized drum will hold 45 lb., but a still denser mass is obtained by first wetting and then compressing.

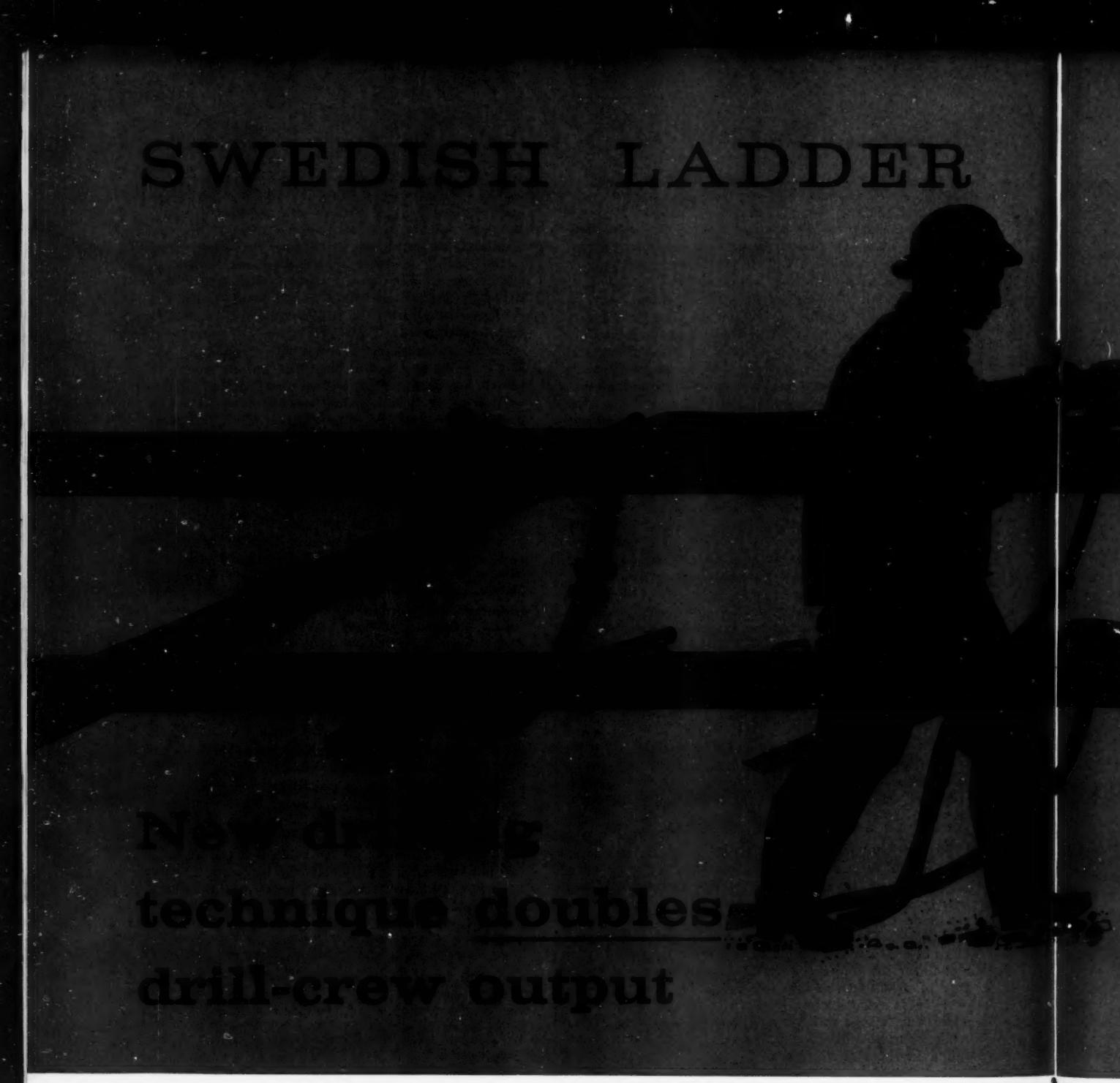
The total amount collected daily, of course, depends upon the richness of the original ore, and although some 70 per cent material has been handled, much poorer ores showed a daily production of about ½ ton blue powder. As regards the remainder of the process, although much of the production is sold as pigment for pottery, etc., part of it is heated with lime to form calcium molybdate for consumption in alloy steel making, and thus the process differs from the wet method of precipitation used elsewhere.

For the production of ferromolybdenum, although accounts of adaptations of the thermit process have appeared, this system is not employed, and in place of reducing with aluminium, reduction is done by means of select ferrosilicon.

Recovery of Cadmium

The recovery of cadmium by distillation as carried out today virtually offsets many of the proposed wet extraction methods, since patented refractory collecting devices allow the bulk of the zinc oxide to pass through, while cadmium oxide is concentrated.

Reverting to the individual oil-fired retort, this is then taken advantage of, and the mixture of fume concentrate and anthracite distilled at low temperatures, this process being repeated until the receiver product approaches 90 per cent cadmium oxide. One of the large metallurgical corporations has this dissolved in sulphuric acid which separates lead, pure zinc then precipitates the cadmium free from iron, while melting under fluxes removes arsenic, when the mass is cast into paper composition moulds which provide 3 ounce rods.



Controlled feed · guided collaring · mechanical retraction— so one man can operate two rigs

NORTHERN SWEDEN has been the proving ground of a revolutionary rock drilling method which has opened the way to a completely new conception of drill-crew output. Known as the Swedish Ladder Drilling Method, this new technique has been employed on hydro-electric projects at Korsselbränna and Stalon where drilling platforms with 16 rock drills operated by 8-man drill crews have been used.

Atlas Copco drills mounted on retractable pusher legs* are rested in cradles running horizontally in "ladders". Contractors and drill crews have found that these rigs, cheaply and simply constructed, offer the following advantages:

INCREASED PENETRATION—full feed power is ensured by the ideal horizontal feeding position of the pusher leg.

HIGHER OUTPUT PER MAN/HOUR—due to greater penetration and the fact that *one man handles two drills.*

REDUCED CREW FATIGUE—collaring is made simple as operators need not hold the drills. Drill steels are mechanically withdrawn from holes using the retractable pusher leg.

FEWER DRILL STEEL CHANGES—long steels can be used from the start. For greater durability 1″ Sandvik Coromant integral steels are used.

GREATER DRILLING ACCURACY—thanks to the fixed ladder base and pre-positioning of drills for pattern drilling.

DRILLING METHOD

DRAMATIC RESULTS OF LADDER DRILL TESTS

The figures show the dramatic increase in drilling achieved by ladder rigs in a 60 sq.m. tunnel at Stalon driven in hard-drilled quartzite. Gross effect refers to the mean value for the whole drilling period, including collaring, changing steels and the usual routine delays. *Note that the gross effect is exactly doubled.*

GROSS EFFECTS

[redacted]

19.5 metres/man-hour Conventional drilling with one rock drill

[redacted]

39.0 metres/man-hour Ladder drilling with two drills

AVAILABLE FROM ATLAS COPCO

The Swedish Ladder Drilling Method was originally introduced by Widmark and Platzer, one of Sweden's leading contracting companies, and has been further developed by them and by the Swedish State Power Board. Specially evolved with Atlas Copco trigger-operated retractable pusher legs*, this method and equipment has been exhaustively tested and proved under tough Swedish drilling conditions. There are Atlas Copco companies or agents in ninety countries and details of the new equipment are readily available from them or from the address below. Wherever you are, the international Atlas Copco group offers expert advice on the selection of equipment and a complete after-sales service.

* PATENTS PENDING

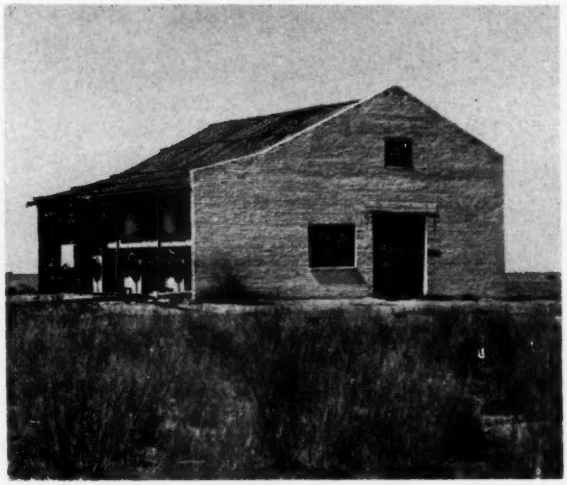
Atlas Copco

PUTS COMPRESSED AIR TO WORK FOR THE WORLD

ATLAS COPCO AB, STOCKHOLM 1, SWEDEN.

The Manganore and Hotazel Mines, North-Western Cape

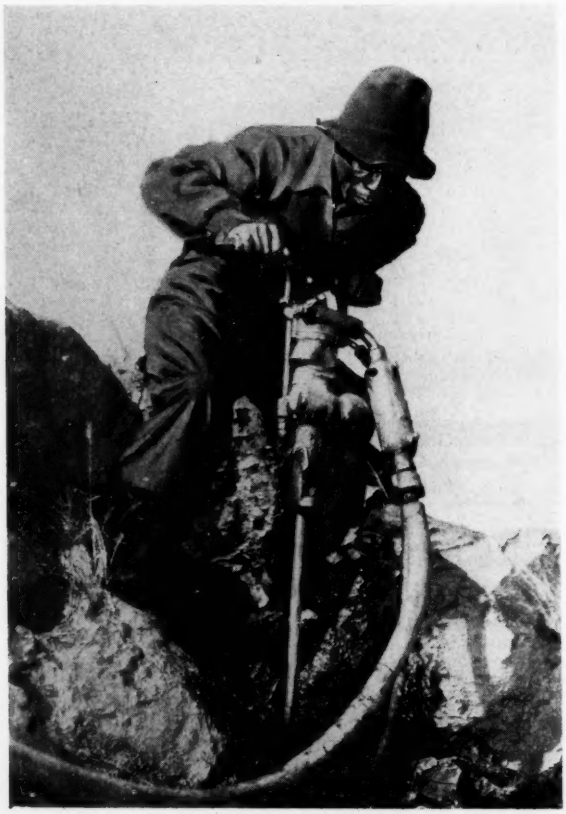
ONE hundred and thirty miles to the north-west of Kimberley, in the semi-desert regions of the North-western Cape where temperatures often reach 115 deg. F. and the annual rainfall is 14.37 in., lies the Manganore iron ore mine.



Openpit Working at Manganore

At Manganore, a mine in the African Metals Corporation group and one of the mines working the Postmasburg deposits, the ore is extracted by openpit methods. Here, mining of manganese deposits, which occurred in pockets in the hills below the iron ore, has ceased, but the mine produces ore with an iron content of up to 66 per cent Fe, and plans are afoot to step up production. All of the production of this mine is railed to the AMCOR works at Newcastle in Natal, where it is converted into pig iron.

The rock at Manganore is among the hardest found anywhere in the world, and much of it is badly fissured.



The combination of these two circumstances makes drilling an extremely difficult task and so far no satisfactory method of longhole drilling has been found. After drilling a single hole to a depth of 2 ft., the tungsten carbide tipped drill steel bit has to be sharpened before it can be re-used. Most holes cannot be drilled deeper than 2 ft; water cooling the drill tip turns blood red as it mixes with the oxide in the iron ore.

After blasting, the rock is loaded by a diesel-driven mechanical shovel into Euclid rear dumps by which it is taken along the winding hillside roads, to the crushing plant. Here it is crushed to +3/16 in. to −1¼ in. before being carried into tubs operating on an endless rope haulage to the loading bins from which it is loaded into waiting railway trucks. Operations recently started at the mine's new Doornpunt section.

The Hotazel Mine

Eighty-five miles north of Manganore lies aptly-named Hotazel, the farm on which S.A. Manganese's newest mine is situated. A little over one hundred miles distant is the Kalahari desert. Water for the mine is piped from a reservoir in the hill some twelve miles away.

Mining operations started early in 1958 and already over 1,000,000 cu. yd. of a soft yellow sand, constituting the overburden in this area, have been removed to uncover the orebody which is rich in manganese. The overburden, 60 ft. deep, is being stripped by electrically-operated shovels which load it on to 22 ton dumpers and other pneumatic tyred vehicles for offloading on the nearby waste dump.

Until the railway reaches Hotazel the ore is being hauled by heavy road vehicles to the railhead at Sishen, 40 miles distant. Sishen is the site of an iron ore mine belonging to the South African and Iron Steel Industrial Corporation (Iscor).

Above, at right, the compressor house at Hotazel Mine. Compressed air needs at the property are supplied by three Atlas Copco AR4 two-stage double acting machines each delivering 855 c.f.m. at 100 p.s.i. At left, alongside, a high speed Atlas Copco BBE 12 DK rock drill in action at Manganore. Expressly designed for hard-rock drilling, the BBE 12 DK provides impact at 4,800 strokes per min. and rotation at 275 r.p.m. The machine weighs 53 lb.

MINING MISCELLANY

Mr. Manuel Elizalde, president of Samar Mining Co., in the Philippines, has informed stockholders that the company's iron mines in Sibuguey, Zamboanga del Sur are now hauling iron ore for stockpiling. The first iron ore shipment to Japan, consisted of about 10,000 tons. The company's Masar mill, at Samar, has been expanded by the addition of a cyanide plant, which recently started operation with a daily capacity of 250 tons.

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Mr. K. A. Gbedemah, Finance Minister of Ghana, has been discussing the financing of the Volta River project in London, and with the World Bank in Washington.

★

Japanese mining experts, including the director and general manager of Nippon Mining Co., are to make a second visit to Cloncurry, western Queensland for fresh investigations into the copper resources. Mr. Vohland, president of the Ore Producers' Association, said that the Japanese had offered to establish at least five treatment plants for copper ore in Queensland, and had been interested in developing the copper field at Mt. Isa, about 70 miles east of Cloncurry.

★

The Montecristo gold mine, in eastern El Salvador, after operating unsuccessfully under subsidized state aid for several years, closed on June 1 last, and the labour force of 311 was discharged. This was the only mine in the country producing gold in commercial quantities. The 1959 gold and silver output were valued at $U.S.85,267 and $U.S.180,100 respectively.

★

Approximately 8,000 tonnes (lead-content) of lead was mined in Greenland during 1959, compared with 8,700 in 1958. Mined zinc output increased, however, to 7,500 tonnes, compared with 6,000 in 1958. In Denmark, smelter lead output rose in the 1958-1959 period from 10,100 to 10,800 tonnes, and smelter zinc production from 2,600 tonnes to 2,800.

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China's production of lead ore amounted last year to 60,000 tonnes (metal content), compared with 47,000 tonnes in 1958, while smelter output rose from 60,000 to 75,000 tonnes. Mine production of zinc totalled 60,000 tonnes compared with 41,000 tonnes, and the same figures, 60,000 tonnes and 41,000 tonnes, are given for smelter production. North Korean mined output of lead in 1959 amounted to 45,000 tonnes of lead, compared with 40,000 in 1958, and smelter production to 25,000 tonnes, compared with 20,000. Mined zinc output remained at 60,000 tonnes for both years but smelter production in 1959 at 20,000 tonnes was double the 1958 output.

★

The Norwegian mining company, Christiania Spigerverk, is starting mining operations near Hammerfest, in north Norway for the extraction of nepheline-syenite. Exploitation is to begin at an annual level of 45,000 tonnes, early in 1961, and the mined material will go to the glass and ceramic industries.

The West German mining concern, Otavi Minen- und Eisenbahn-Gesellschaft, of Frankfurt a/M has announced the construction of a new perlite plant at Dorfprozelten a/M. In South Africa, the company is planning to reopen its platinum mine at Driekop early next year. This mine was closed early in 1958 because of unfavourable prices then ruling; reopening will not involve heavy costs.

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The Swiss-owned Chinese aluminium Rolling Mill Inc., of Shanghai, which was the last foreign-owned private company in China, has been taken over by the Chinese Government.

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Special provisions made by the Ontario Government recently will now permit gold by placer mining. Three companies are planning to undertake exploration or dredging work along the Vermillion River, north of Sudbury, and the Ontario Department of Mines has issued a dredging lease to Concor-Chibougamau Mines, covering 2,215 acres in Norman, Parkin and Hutton townships, near Milnet. The ten-year renewable lease, which runs from July 1, requires that within two years the company install a dredge with the capacity to handle at least 3,000 cu. yds. of gravel per day.

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The Chicago and North Western Railway will build an infra-red ore thawing facility near its dock at Escanaba, Mich., at a cost of more than $250,000, reports the *Wall Street Journal*, in time for operation this autumn. The new facility will replace the steam thawing methods used previously to thaw iron ore that has frozen while being hauled by rail from Upper Michigan and Northern Wisconsin mines to the docks. The ore, which comes out of the mines wet, freezes in the cars, and this prevents dumping through hoppers on the ore dock and into the holds of ore boats until it is thawed. The infra-red principle of thawing is considered more efficient and will permit quicker movement of iron ore and an extension of the ore shipping season.

★

For the Durgapur Steelworks the U.K. Government is financing, under the Technical co-operation Scheme of the Colombo Plan, the training in the U.K. of 350 engineers for the supervisory staff of the works. Up to the end of June, 1960, 247 engineers had come to the U.K., of whom 168 have returned to India. The last group of engineers is expected about February, 1961.

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Mr. Michaelson, general manager of the Western Mining Division of Kennecott Copper Corporation, has announced that contracts had been signed for about $750,000 in respect of pilot plant equipment at the firm's Garfield smelter for experiments using oxygen in the smelting of copper. Following experiments in the pyrometallurgical department of the Kennecott Research Centre in Salt Lake City and at Chino, New Mexico, the oxygen will be used in reverberatory furnaces in testing the speed of processing.

In the first half of 1960 crude oil output in Albania increased by 41.3 per cent, compared with the corresponding period in 1959; iron ore by 42.7 per cent, and chromite (134,121 tonnes) by 14.9 per cent. The latter figure compares with an output of 122,094 tonnes in the whole of 1955.

★

The Institut Equatorial de Recherches et d'Etudes Geologiques et Minières, whose activities cover the four countries of former French Equatorial Africa, has announced the discovery of bauxite in the Mundu area of Chad. The bauxite has a high alumina content, though reserves are estimated at only 10,000,000 tonnes, and exploitation would be difficult owing to the great distance from the coast. The Institut also states that it is soon to start prospecting for bauxite in the south of the former colony of French Congo, not far from Tschéla, where reserves were recently found of over 100,000,000 tonnes.

★

Plant for the processing of 350,000 tonnes of non-ferrous metal ores, and for the annual production of 350,000 tonnes of coke is reported to have been constructed in North Korea in the first half of 1960. A non-ferrous metals plant is also under construction.

★

The Société des Mines de Fer de Mékambo, which is conducting exploration in Gabon for iron ore (see *M.J.*, August 12, p. 174) plans to concentrate its efforts during 1961 on the Belinga hills, in eastern Gabon, where 250,000,000 tonnes of ore with a ferrous content of 63 per cent have already been located. This area is expected to contain some 500,000,000 tonnes of ore. A further 250,000,000 tonnes have been discovered by the company in the Boka-Boka massif near Mékambo. If the Belinga reserve is not sufficient, work will begin on exploring the Batoula massif, also in East Gabon. Exploitation is not expected before 1970.

★

The Finnish mining and metals firm, Vuoksenniska Oy, is to start mining its Jussarö iron ore deposit at the end of 1961. The ore to be exploited is located below the sea bed off the south coast of Finland.

★

The Hungarian news agency, M.T.I., announces that India has placed an order worth Rs. 750,000 for mining machinery with the Hungarian trade corporation, Nikex.

★

The West German steel groups, Klöckner, Röchling and Stinnes, are to co-operate in building an ore-handling port on a site in Bremerhaven put at their disposal by the State Government of Bremen. Two ore vessels, each with a loading capacity of 60,000 tonnes, will be able to be unloaded simultaneously at the new site. By the end of 1961, the port will have an annual ore turnover capacity of up to 4,000,000 tonnes. Later this capacity is to be extended to between 9,000,000 to 10,000,000 annual tonnes. The harbour will probably be called "Weserport".

Machinery and Equipment

Variable Speed Reduction

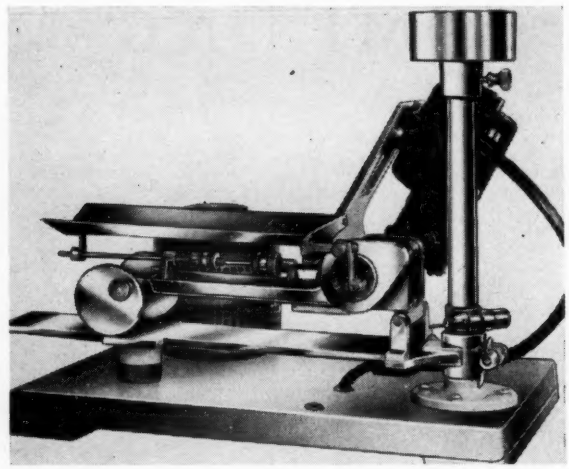
The Contorq unit is claimed by the manufacturers, Fairbairn Ulro Ltd., a subsidiary of Fairbairn Lawson Combe Barbour Ltd., to be an entirely new venture into the field of variable speed transmission. The unit is of comparatively simple construction, built on robust lines to precision standards. The Contorq is described as revolutionary in that it is completely positive, based on sound mechanical principles and, by the complete absence of fluid or friction properties, will maintain accurately the selected speed, regardless of changes in temperature, humidity of atmospheric conditions which so often affect other variable speed units.

The standard unit operates from a constant input speed of 450 r.p.m., which gives an infinitely variable speed range on the output shaft of 0-50 r.p.m. Speed changes are made by the turn of a graduated dial, and speed changes may be effected whilst the unit is in operation or at rest. Remote control by servo or push buttons can be provided if required. As the name implies, the Contorq will transmit constant torque throughout its entire speed range.

The unit has machined faces both on the input and output sides. These machined faces are intended for the mounting of auxiliary equipment, i.e., flange-mounted motors, output attachments such as worm and wheel units, bevel attachments for change of direction, differential arrangements which will increase the output speed from 0-100 r.p.m. or a variation of 100 r.p.m. at practically any speed, i.e., 200-300 r.p.m., or 900-1,000 r.p.m. Provided with a machined base, and four holes for fixing bolts, the unit can be supplied with either right or left handed input and output shafts. It is completely sealed and self-lubricating, with oil level indicator, and will run continuously with no attention other than an occasional topping up with oil.

Consideration of the illustration below shows that two single lobe cams B are secured to the input shaft, the cam lobes being fixed at 180 deg. to each other. Rotation of the cams imparts an oscillating movement to two levers C which, in turn, oscillate two levers D, each of which is in contact with a roller type freewheel mechanism E attached to the output shaft F. Adjustment of the control knob C moves roller H which is interposed between the levers C and D, thereby varying the angular movement of the two levers D from zero to a maximum. The angular arrangement of the cam lobes imparts a continuous motion to the output shaft, i.e. as one freewheel is driving the other is returning to its starting position. The cams are designed to give constant angular velocity and overlap to eliminate loss of movement at the change from one freewheel to the other.

Total weight of the No. 25 unit, including 6 pts. of oil, is 385 lb. Overall dimensions are length 26½ in.; width (over shafts) 21¼ in. and height 15¾ in. The unit finds application in mining, mechanical engineering and mechanical handling.



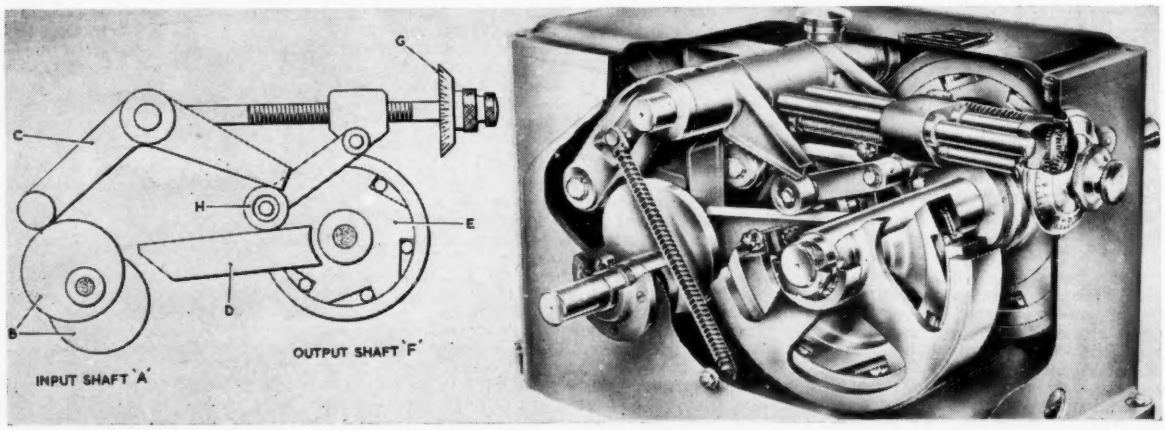
At right, alongside, the Micropanner by Chas. W. Cook and Sons Ltd. Below, diagrammatic sketch and cutaway photograph of the Contorq unit by Fairbairn Ulro Ltd.

SMALL QUANTITY GRAVITY CONCENTRATION

The Micropanner, a small scale version of the Haultain Superpanner, is manufactured by Chas. W. Cook and Sons Ltd., under licence to the United Kingdom Atomic Energy Authority from the original designs of L. D. Muller. Briefly, the instrument consists of a non-ferrous metal frame hinged to a baseplate, this frame supporting through three bearings, a reciprocating shaft on which is mounted a metal deck, variation of the slope of deck being by a pair of cams. The spring loaded reciprocating shaft is actuated by a ratchet wheel which is driven through gearing by a fractional h.p. motor; the speed of this motor being controlled by a small auto transformer.

The shaft carries threaded stop and locknuts enabling the amplitude of shaft movement to be varied between zero and 3/32 in. A further milled nut on this shaft enables compression on the return spring to be varied. A rocking motion, transverse to the axis of the shaft, is applied to the deck through linkage mechanism, and an adjustable eccentric mounted on the ratchet wheel spindle.

The apparatus is supplied complete with two lino covered decks, one aluminium weired deck and one aluminium open ended deck, the weired deck having a small spring clip to carry a bent capilliary tube between bottle trap and suction point. The whole apparatus is mounted on a wood baseboard and includes geared motor unit, auto transformer, switch and bottle support.



Metals and Minerals

Cuban "Intervention" in Moa Bay?

A cable from Havana dated August 14 stated that Cuba planned to "intervene" in the operations of the U.S. owned Moa Bay Mining Co. "within a few hours", according to an announcement by President Osvaldo Dorticos. No further news of this proposed action has since been received.

A few days ago the Cuban Government set up a national institute of mining, a step which could have been a preliminary to a take-over of the U.S. mining properties that had escaped Premier Fidel Castro's recent nationalization of most American holdings in Cuba. The institute, which has been made a division of the industrialization department of the National Institute of Agrarian Reform (I.N.R.A.), is empowered to "plan investigation and development of mineral production". Before seizing the foreign-owned oil refineries in Cuba, the government created a national petroleum institute as part of I.N.R.A. and entrusted it with the responsibility of running the expropriated companies.

The two largest mining interests in Cuba are the Moa Bay Mining Co., a subsidiary of Freeport Sulphur, and the Nicaro nickel plant owned by the U.S. Government. Moa Bay Mining, located in Oriente Province, suspended operations in April, claiming that it could not make a profit under the conditions stipulated by Cuba's recently introduced mining laws. The plant is valued at around $75,000,000. The company planned to produce 25,000 s.tons of nickel and 2,200 s.tons of cobalt annually. Although not yet in full production, it was employing about 1,500 Cubans and would have become one of the island's largest taxpayers.

Why President Dorticos used the word "intervention" (which does not mean confiscation) instead of expropriation or nationalization, as is expected for the rest of American property, is not yet known. It is also hard to see what benefit the Cuban Government could derive from the Moa Bay undertaking without access to Freeport's refinery at Port Nickel, constructed at a cost of $45,000,000 to treat the difficult Cuban ores.

Meanwhile, the future of the Nicaro plant is still the subject of discussion between the two governments. State Department officials arrived in Washington early this month to resume negotiations for its possible sale to Cuba. The plant is operated by the National Lead Co. on a fee basis through the Nicaro Processing Corporation. Operations at the plant have been sharply controlled and its products are being stored in Cuba. The plant has a capacity of 25,000 s.tons of nickel oxide powder and sinter a year. Production is believed to have dropped to an annual level of less than 18,000 s.tons.

As indicated in our issue of July 29, p. 128, Cuban nickel is unlikely to be an important U.S. market factor, since Canadian producers are having no difficulty in meeting requirements, even though Inco's Thompson project is not yet in production.

The effects on cobalt supplies, in the event of an indefinite suspension of production at Moa Bay, would appear to be largely dependent on developments in the Belgian Congo, which is by far the world's largest producer of this metal. In what now appears to be the improbable event of a prolonged stoppage of the Katanga mines, any future supply difficulties would obviously be accentuated by the interruption of Moa Bay's planned programme of production, but this is a long-term problem which may never arise.

STEADY WOLFRAM MARKET

The wolfram ore shipment market in London has lately been displaying marked steadiness, which so far has not been disturbed by the impact of seasonal influences. Sellers have shown no undue anxiety to sell and this has probably contributed in no small measure to the maintenance of prices. A slightly narrower shipment price range of 157s.-162s. per l. ton c.i.f. Europe is now indicated, compared with 156s.-162s. previously. This is the first change since early July, and is understood to reflect the level at which the better business has been done in the past few days.

NICKEL IN JET AIRCRAFT

The use of nickel in jet engines is the subject of a letter by Mr. Henry S. Wingate, chairman of International Nickel, to the company's shareholders. Most of the special alloys for jet engines today contain nickel, it is pointed out. Some are alloys developed and produced by Inco and others are alloys to the development of which the company's research scientists and engineers made substantial contributions.

The engines of a typical jetliner contain about 2,500 lb. of nickel, or 1¼ tons. Some of the engine parts that contain nickel are gear boxes, combustion chambers, turbine shafts, turbine discs, rotor blades, tail cones, noise supressors and thrust reversers. The amount of nickel in these parts ranges from 1.75 per cent in the shaft upon which the rotor discs and compressors are mounted to the 75 per cent nickel alloys used in the parts of the engine subject to the highest temperatures. In addition, there are about 200 lb. of nickel in the jetliner airframe and accessories. Such items as landing gears, hydraulic pumps and engine mounts, as well as galleys and washrooms, are made from alloys containing nickel.

Speeds approximating 600 m.p.h. are being attained by today's commercial jetliners, with advanced designs under

LONDON METAL AND ORE PRICES. AUGUST 18, 1960

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 6d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt. 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 249s. 11½d
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28½/28½
Quicksilver, £69½/£70 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 79¼d. f. oz. spot and 79¼d. f'd
Tellurium, 25s. 0d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	20s. 6d./21s. 6d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)	240s./245s. per l. ton unit BeO
Bismuth	30% 5s. 0d. lb. c.i.f.
	20% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
" Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
" Refractory 40% (Ratio 3 : 1)	£11 0s. 0d. per ton c.i.f.
" Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) Nb_2O_5 : Ta_2O_5	180s./185s. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s/85s. per ton f.o.b Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 67s. 6d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO_2 (prompt delivery)	£28 0s. 0d. per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	157s./162s. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16/£16 10s. ton c.i.f.

study for jetliners which could attain speeds in excess of 1,500 m.p.h. At these supersonic speeds, the heat generated by the frictional effects is so great that the wings and fuselage have to be made of heat-resistant material. At the still higher speeds required for the first aircraft which will carry man to the fringe of outer space and back, material with even greater resistance to heat is needed. The skin of the first experimental aeroplane for this purpose is fabricated from a 75 per cent nickel alloy developed and produced by INCO.

FINANCE FOR THE VOLTA PROJECT

Negotiations in London and the U.S. regarding the provision of finance for the £60,000,000 Volta hydro-electric project in Ghana are understood to have been successfully concluded. Mr. K. A. Gbedemah, the Ghanaian Finance Minister, stated in Washington last week that the U.S. Government and the World Bank had offered loans which should now enable this project to go ahead. He added that Ghana was seeking loans for approximately half the cost of the project. Mr. Gbedemah has since held talks in London with the Chancellor of the Exchequer, Mr. Selwyn Lloyd. The upshot seems to be that the British and U.S. Governments and the World Bank have agreed to provide, between them, credits totalling £30,000,000. The remainder will be found by the Ghana Government from its own resources.

It still remains to conclude Ghana's negotiations with the international consortium of aluminium producers formed under Kaiser's auspices to consider the possibility of using the hydro-electric power for the conversion of bauxite into alumina. Prospects for a successful outcome of these negotiations are regarded with optimism.

*

Tinplate sales officials in Pittsburgh disagree with the claims made recently by aluminium producers (vide *The Mining Journal*, August 5 1960, p. 155) that "almost all" the 1960/61 output of frozen citrus juices will be in aluminium cans, reports the *American Metal Market*. Describing such claims as exaggerated, they contend that the battle between tinplate and aluminium for this important container market is still being fought "tooth and nail' and that tinplate expects to hold its own. In the battle to come the steel industry will soon have an important new weapon, notes our contemporary. This is a very thin tinplate which will offset aluminium's advantage of a lighter weight.

ATLAS IN EUROPE

The production, processing and marketing of ferrous metals, non-ferrous metals and minerals are to be undertaken by a new company set up in Rome by Atlas Steels under the name of Atlas Steels (Italy). Further aims of the new company, which will have a capital of 120,000,000 Lire, are the purchase and operation of plants and undertakings in Italy or elsewhere concerned with the processing and transport of and trading in ferrous and non-ferrous metals and allied derivatives, and the takeover of Italian and foreign companies' agencies employed in the same field.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

There has been some increase in the volume of business during the week as works re-open after holiday shutdowns, but there has been little broadening in actual consumer interest in any of the metals and in the absence of fresh features the market has shown little change. The situation in copper is still dominated by a variety of imponderables and the future outlook is almost entirely dependent on how these develop. Tin has been an uncertain market, whilst lead and zinc have registered no significant change.

HIGHER COPPER STOCKS

Although from the production point of view, the situation in Katanga appears more stable, there still remains the problem of moving the copper to the port of shipment and in the event of any disturbances or strikes arising this is where delays could occur. In Rhodesia the recent claim for increased wages is still outstanding, whilst the trade maintains an anxious eye on the political scene. No progress has been made in the negotiations for a new labour contract for the Chuquicamata workers in Chile and both sides appear to be as far apart as ever; the present contract runs out at the end of September and the general feeling persists that a strike cannot be avoided some time during the following month. As against these factors, world production is currently running well ahead of consumption and stocks on hand with producers showed a substantial increase in July. Exact figures in tons:

	U.S.		*World*	
	July 1960	*June 1960*	*July 1960*	*June 1960*
Stocks	91,714	87,667	277,896	250,535
Refined Production	129,771	161,073	167,190	168,445
Shipments	83,788	106,207	183,633	199,757

Sentiment in London was affected by these discouraging figures and the continued lack of interest on the part of consumers. Furthermore, stocks in London Metal Exchange registered warehouses increased again last week by 234 tons and in the face of substantial offerings of a general nature of nearby metal a small contango was temporarily established. This resulted in more buying interest including covering against recent sales to Eastern Europe.

In the U.S. both the custom smelters and the main producers report quiet conditions, although the latter expect August business to show an improvement on July. Even if this takes place it is unlikely to be sufficient to absorb the full output. Some doubts were raised during the week on the ability of the custom smelters to maintain their price at 33 c., as reports indicated September metal was on offer from these sources at 32 c. However, bearing in mind the light offerings of scrap in recent weeks it is expected that the price will be maintained at the present level unless the London quotation becomes established at something under £240.

TIN PRICES EASE

Lower Eastern advices, the availability on the Continent once again of the well-liked Banks Tin now smelted in Malaya and quiet outside demand, have all contributed to a featureless tin market and lower prices. Malayan shipments from Penang during the first half of August amounted to 3,139 tons compared with 3,020¾ in the first half of last month. Stocks in London Metal Exchange official warehouses at 9,564 tons at the end of last week showed an increase of just 9 tons.

On Thursday the Eastern price was equivalent to £808 per ton c.i.f. Europe.

STRONGER LEAD-ZINC MARKETS

The new dealing period for lead and zinc has seen a narrowing in the contango rates — incidentally the official closing quotations last Monday morning showed a contango on each metal traded in on the exchange—as selling pressure on the nearby position has been less intense and there have been some indications of a revival in consumer demand.

Strike action in the U.S. is currently affecting zinc production to a substantial extent. At the New Jersey Zinc Co.'s two smelters and several mines, and at the Bunker Hill Co.'s and American Smelting and Refining Co.'s mine in Idaho, the loss is estimated at about 17,000 tons of zinc and about 8,000 tons of lead. The New Jersey strike accounts for about 10,000 tons of this which goes some way towards offsetting the increase in stocks in July of 19,373 tons. The U.S. quotations for both metals at 12 c. for lead and 13 c. for zinc are regarded as fairly well assured under present conditions.

Closing prices are as follows:

	August 11 *Buyers*	*Sellers*	August 18 *Buyers*	*Sellers*
COPPER				
Cash	£245	£245½	£245½	£245¾
Three months	£244¾	£245	£244	£244¼
Settlement	£245½		£245¾	
Week's turnover	8,475 tons		10,775 tons	
LEAD				
Current ½ month	£70	£70½	£71½	£71¾
Three months	£70¾	£71	£71¾	£72
Week's turnover	6,725 tons		5,075 tons	
TIN				
Cash	£803¼	£804	£793½	£794
Three months	£805½	£806	£797	£798
Settlement	£804		£794	
Week's turnover	715 tons		700 tons	
ZINC				
Current ½ month	£88⅜	£88½	£87½	£87½
Three months	£88½	£88⅝	£87⅜	£87½
Week's turnover	3,575 tons		6,000 tons	

Mining Finance

Good Outlook for Consolidated Tin Smelters

The annual report of Consolidated Tin Smelters is notable for a number of things. Firstly, the tonnage of tin concentrates treated at the company's smelting works at Bootle and Penang should in 1960-61 approach that attained in the year to March 31, 1958. The chairman, Mr. Clifford Waite, thus anticipates "some increase" in the group's trading profits for the year to next March.

He is confident that the outlook for the tinplate industry is "extremely healthy". He is supported in this belief by the extensive programme of expansion which the industry is pursuing in Britain and other countries. Mr. Waite, however, is cautious about whether or not it would be wise for the International Tin Council to relax its output controls completely. Before doing so the Council must be certain that the statistical position and general world conditions fully justify this step. Neither consumers nor producers would welcome freedom from controls if such freedom were to be of only short duration. The course of tin prices during the past months indicate, the chairman thinks, that production and consumption must be very closely in balance.

Altogether, Mr. Waite's review is an optimistic one both for his own company and for tin producers generally. Consolidated Tin Smelters £1 Ordinary stock stands at 49s. 4½d. cum the dividend of 3s. and bonus of 6d. to yield 7.4 per cent.

PAYABILITY IMPROVES AT SAAIPLAAS

There was a little more favourable news for Free State Saaiplaas shareholders at Wednesday's extra-ordinary meeting in Johannesburg. In July reef payability was the best since the initial quarter's development in June, 1959. Last month 1,335 ft. of Basal reef were sampled of which 950 ft., equal to 71 per cent, were payable with an average gold value of 6.3 dwts. a ton over an estimated stoping width of 50.6 inches, or 319 inch-dwts. These data, the chairman said, indicated a continuation of the upward trend in percentage payability and in the average payable value disclosed by development during recent months. Connections between the Nos. 1 and 2 shafts had now been effected underground on both the 7th and 9th levels and preparations for stoping were in hand.

Up to June 30 last this Gold Fields group Orange Free State mine, now due to start trial milling in October, had sampled 6,765 ft. of reef of which 50 per cent had been payable with average values of 387 inch-dwts. Last month's values are thus still not all that exciting. A circular containing particulars of the offer to share and note holders of new 10s. shares at par together with a form of application will be sent out on August 31.

WESTERN SELECTION QUARTERLIES

Progress at the four Ghana gold producers in the Western Selection group is outlined in the June quarterly reports.

Profits have been rising over the past nine months at Bremang and Ghana Main Reef, but falling at Amalgamated Banket and Ariston as the following table shows. The last-named, as stated in the monthly returns, has been suffering from grade control difficulties. These continued in July, but an improvement was said to have been shown.

A.B.A.'s profits are pursuing an erratic course just now. Current earnings, however, are not the vital point for this company. The management is concentrating on putting the financial assistance from the Ghana Government to the best advantage so that this low-grade mine may be put back onto a sound technical footing.

Bremang's profit performance last quarter was particularly good because it was achieved despite the No. 1 dredge having been out of commission for major repairs from June 20 to July 3 and despite flooding having caused "considerable inconvenience" towards the end of the quarter.

As regards reef development, there are some interesting initial results on the 30th level of the No. 2 orebody at Ariston where three successive north crosscuts have given 5.8 dwts. gold per ton over 94 inches, 6.5 dwts. over 62 inches and 6.3 dwts. over 81 inches. Footwall driving to the south is stated to be progressing as rapidly as possible. In the previous quarterly it had been revealed that the drive south on this level was approaching "an important phase" in the programme to explore this orebody at 450 ft. below the 27th level. Further results from this area will thus be awaited with interest.

Ghana Main Reef reports that of 480 ft. sampled in the June quarter in the Tuappim shaft section 455 ft. or 95 per cent, were payable averaging 12.23 dwts. over 56.2 inches.

	Dec. qtr. £	*Mar. qtr.* £	*June qtr.* £
Amal. Banket	90,530	52,931	50,991
Ariston	153,489	151,711	139,443
Bremang	75,814	81,180	83,213
Ghana M. R.	39,045	45,278	49,063

FAVOURABLE NEWS FROM G.M.K.

The full report of Gold Mines of Kalgoorlie brings the answer to the question put forward here last week when commenting on the preliminary profit statement for the year to last March. And it is a favourable one. Namely, that the results were markedly less dependent on the subsidy under Australia's Gold Mining Industry Assistance Act than they were in the previous year. Then the net profit was £248,686 after crediting £313,672 from the subsidy. For 1959-60 the net surplus of £323,869 is arrived at after a subsidy of only £204,920.

The main reason for the decreased assistance is the mine's improved gold recovery which at 5.54 dwts. a ton compares with 5.36 dwts. in 1958-59. This, of course, reduced the cost per ounce and so cut the amount for which the company qualified under the Assistance Act. The ore reserves on March 31 last were slightly higher at 1,287,000 tons, against a mill tonnage of 524,461, and the average gold content was 0.1 dwt. up at 5.8 dwts. It thus looks as though G.M.K. may be able to maintain its mill grade in the current year. It is to be hoped that the chairman, Mr. G. Lindesay Clark, will be able to give some guidance in this respect at the meeting in Melbourne on September 6.

G.M.K. is an Australian registered company so, as pointed out here last week, all the figures concerning it are in Australian currency and in calculating the yield to U.K. shareholders allowance has to be made for the exchange loss in converting the 1s. dividend to sterling. The increase just announced in Australian company tax from 7s. 6d. to 8s. in the £ will, incidentally, have little effect on G.M.K. because gold-mining is tax free in Australia. Last year the company paid £19,387 in tax, but this was largely on income from the sale of pyritic concentrates for the extraction of sulphur for fertilising purposes. G.M.K. 10s. shares have improved to 8s. at which the yield is 10 per cent.

PENGKALEN'S TAX ADVANTAGE

At the Pengkalen meeting in Redruth Major W. E. Hosking, the chairman, said that the auditors of this Malayan tin producer had been negotiating with the Inland Revenue on tax matters connected with the company's buffer stock contributions. The results of these negotiations had been to establish a basis which was of "considerable advantage" to the company and therefore to shareholders. Pengkalen had contributed £36,759 to the Buffer Stock and it seemed reasonable to assume that "in the foreseeable future" a refund of at least a substantial part of this would be received.

The company's sales of tin ore in the first nine months of its current financial year to September 30 next have totalled 294½ tons against 244 tons for the whole of 1958-59. Pengkalen 1s. Ordinary shares stand at 7s. 9d. ex dividend. Last year's distribution is equal to 4.2d. per share on the present capital. So far two interims totalling 4½d. have been declared on account of 1959-60.

PETALING'S OPENCAST PROJECT

There is some good news from Petaling Tin, the Malayan producer. Plans are in hand to exploit by opencast methods part of the areas that have already been worked over by the Nos. 3 and 4 dredges. A bucket wheel excavator is to be employed in taking out economic values left behind because they were too deep to be extracted by these dredges. An output quota has been applied for to the Controller under the Tin Control Regulations, the area being regarded by the company as a new mine. The project, it is stated, together with the liquidation of the present bank overdraft, is to be financed by sale of part of the company's investments "as these funds can thus be more profitably employed".

Petaling's experiment will no doubt be watched with considerable interest because there must be considerable acreages in Malaya which contain deep-lying tin values that have been passed over by existing dredges and which would require a highly expensive modern deep-digging dredge to extract them.

The bringing back into operation of one of Petaling's idle dredges is also foreshadowed. For reasons of economy the company's quota has hitherto been produced by the No. 6 dredge and by drawing on accumulated stocks. With increasing quota releases, this, it is stated, may no longer be possible.

BROKEN HILL SOUTH OPERATIONS

Broken Hill South Ltd. has been prospecting on the western side of its leases for some time, and results have warranted the continuance of that work. An extensive mineralized zone occurs along the western size of the South Mine leases, its presence indicated by the initial diamond drilling from the bottom levels of the South Mine. As work progressed it was found that this zone extended northward and underlies the city of Broken Hill. Holes had been drilled westward from Delprat Shaft, in the old Broken Hill Proprietary Mine, before the leases were relinquished, to prospect at greater depth for repetition of the upper ore bearing beds, but without success. It has been found that repetition beds can be better reached by surface drilling and a depth of 4,700 ft. has now been reached. A second drilling rig has been put into commission, and this bore has reached a depth of 1,000 ft.

The South Company has already spent £A.750,000 on the prospecting work in this ore zone, in which it is hoped that orebodies of economic importance will be found. South Mine surveyors consider that the ore zone extends right across the city, from north to south, and that the deeper beds hold promise of containing useful ore deposits. It is not expected that such orebodies will be met above a depth of 3,000 ft. Favourable results from this work would have a very important bearing on the future of the South Mine.

INTERIM FROM INCO

The interim report of The International Nickel Company of Canada, Limited, and subsidiaries for the six months ended June 30, 1960, shows net earnings in terms of U.S. currency of $43,902,000 after all charges, depreciation, depletion, taxes, etc., equivalent to $1.50 per common share. The earnings per common share are adjusted to reflect the two-for-one stock split which became effective April 28, 1960. For the first six months of 1959 net earnings were $38,391,000, or $1.31 per common share. Net earnings of $18,970,000, or 65 c. per common share, in the three months ended June 30, 1960, compare with $24,932,000, or 85 c. per common share, in the first quarter and $21,407,000, or 73 c. per common share in the three months ended June 30, 1959.

"As anticipated in the first quarter report, deliveries of nickel in all forms during the second quarter were less than the record high deliveries made in the first quarter," states the report. "The company is continuing to augment its supplies by nickel acquired in connection with the reduction of the United States Government's procurement contract obligations. Inventories and cost of sales continue to reflect the cost of this nickel, which was purchased at market prices."

Capital expenditures of $36,179,000 were made during the first six months, compared with $30,527,000 for the first six months of 1959.

BISICHI-JANTAR STALEMATE

The Bisichi battle for Jantar is still inconclusive. The first-named has announced that it has declared its bid unconditional although acceptances "have fallen short of a majority holding". How short, is not stated. Late acceptances are to be received until August 31.

The Jantar Board are still urging their stockholders not to accept. They say that "it is clear that the majority of Jantar stockholders do not regard the offer as being good enough," an opinion which the chairman, Mr. R. T. Janson, fully shares.

It is difficult to say where these two flourishing and adjacent Nigerian tin-columbite producers can go from here unless the two Boards are willing to get together and negotiate an amalgamation on mutually suitable terms. The present stalemate is hardly an ideal solution of this wordy struggle.

Aluminium Ltd.—The continued recovery of the aluminium industry is reflected in the half-year's results of Aluminium Ltd. Consolidated net income for the six months ended June 30, last, was $21,819,000, equivalent to 71c. per share, against $10,570,000 in the corresponding period of last year (35 c. per share). The Aluminium Co. of Canada, whose accounts are consolidated with those of its parent company, reports six months' net income of $14,092,854 before payment of preferred dividends, compared with $5,604,053 in the first six months of 1959. Consolidated sales of aluminium over the half year were 360,000 tons, some 64,000 tons higher than the same period last year.

Consolidated Gold Fields.—Consolidated Gold Fields announces that, through its subsidiary company, Gold Fields American Development, 3,500,000 shares of the unissued capital of Commonwealth Mining Investments (Australia) will be subscribed in cash at par (10s. Australian), subject to the approval of that company's shareholders at an extraordinary general meeting which will be convened shortly. The present issued capital of Commonwealth Mining is £A1,451,500 and its interests are predominantly in gold, copper and zinc undertakings in Australia. The successful conclusion of the arrangements contemplated, which will result in Commonwealth Mining becoming a subsidiary company in the Gold Fields group, will enable Commonwealth Mining to undertake a further expansion of its business ; at the same time it will substantially increase the interest of the Gold Fields group in the Australian continent.

LONDON MARKET HIGHLIGHTS

South African Gold shares remained relatively undisturbed by events in the Congo last week. But although the market remained comparatively steady, business dwindled even further. Much of the steadiness stemmed from a modest but persistent enquiry from Johannesburg.

Free State Geduld and Western Holdings stayed at around 118s. 9d. for most of the time. Harmony (30s.) and St. Helena (65s.) tended to harden on hopes connected with next month's dividend announcements. Johannesburg occasionally supported Leslie (16s.) and Bracken (26s.) and was often a buyer of West Rand issues including "Writs" (45s.) and Western Reefs (24s. 6d.).

Such London interest as there was centred on the Finance group, notably in Gold Fields which strengthened to 61s. 6d. following news of the group's proposal to acquire an Australian interest.

Business was also at a low ebb in the Copper share market. But there was little Cape support to hold prices, which tended to be swayed by developments in the Congo. After opening firmly on Monday they fell sharply on Tuesday and were barely steady on Wednesday. Nchanga came back to 56s. 3d. from Friday's close of 58s. 9d. and Bancroft were looking decidedly weak at 17s. 10½d. "Tanks", however, which might have been expected to be particularly influenced by the Congo troubles, showed little change on balance at 30s. 6d.

The most outstanding feature of Mining markets was the sharp see-saw movement in Tin shares. A growing feeling that the technically inspired setback in share prices had gone too far was coupled on Monday with a sudden revival of Singapore buying. It was soon obvious that stock was none too readily available and widespread advance in prices took place. In the lead were Tanjong and Sungei Besi, which spurted 1s. 9d. apiece to the common price of 27s. 9d. Rises of 1s. 6d. were reported in Ayer Hitam (23s. 9d.) and Tronoh (39s.) among many other sizeable gains.

But hardly had the market opened on Tuesday, when jobbers hurriedly began to mark prices down again on fears of profit-taking following a cessation of the previous day's Singapore demand. This check to demand from the East in turn stemmed from a setback in the tin quotation there. By the close of the day Tanjong had reacted to 25s. 6d. and Sungei Besi were back to 26s. 3d. On Wednesday, however, they recovered to 26s. and 27s. respectively.

In the take-over battle between Bisichi and Jantar, the former announced that its offer was now unconditional despite the fact that a majority holding had not so far been achieved. The latter company drew attention to the fact that Bisichi still did not have control and advised undecided shareholders to do nothing. The effect on share prices was to lower Bisichi to 5s. 7½d. and Jantar to 6s. 6d. At these levels the Bisichi offer is equivalent to 6s. 7½d. per Jantar.

The Australian budget with its proposal to raise company taxation by 6d. to 8d.in the £ had little effect on share prices. As far as the gold mines are concerned no reaction was expected because these companies are not taxed on their gold operations.

Elsewhere, Trepca sagged to 4s. following the liquidator's report. This held out little hope of an early conclusion to the endless Pasic litigation and cast doubts on the previous 8s. 6d. (or 2s. 1½d. per Trepca) a share valuation of the Treselca holding.

Mine Manager required for small but developing barytes mine in Scotland. Graduate in metalliferous mining, about 35, with good operating and mine planning experience preferred. Write for application form in first instance to Box 672, c/o *The Mining Journal*, 15 Wilson Street, Moorgate, London, E.C.2.

BUFFELSFONTEIN GOLD MINING

It is now reported that it has been decided to seal off completely the stope affected by the underground fire at Buffelsfontein Gold Mining Co., and this is now in progress. The stope is isolated and there is no danger of the fire spreading to any other part of the mine. As a precautionary measure, personnel have been temporarily withdrawn from those workings in the immediate vicinity of the fire, but the remainder of the mine is carrying on normally.

CORNISH MINING: Wanted for study books, accounts, documents, worthless shares. Brooke, Kennet End, Harrow Park, Harrow on the Hill, Middlesex.

FEDERAL GOVERNMENT OF NIGERIA

ORE DRESSER

ORE DRESSER required by the Federal Ministry of Mines and Power for duty at Jos, Northern Nigeria, to undertake research into problems of mineral dressing, particularly in connection with the mineral recovered in the Plateau Tin fields. This may involve investigations in the field. The successful candidate will also undertake the training and education of members of the public and of the Mines Division in ore dressing and related subjects, and also supervise and organize the Customs treatment of minerals. The appointment will be for one tour of duty in the first instance. Candidates must possess a first or good second class Honours Degree in Mineral Dressing or Metallurgy and consideration will be given to those with post-graduate experience. Experience in teaching and Customs milling also an advantage.

Salary according to age and experience £900 - £2,196 per annum, including Inducement Addition, plus a gratuity of £100-£150 per annum for satisfactory service. Outfit allowance of £60 is payable on a basic salary not exceeding £1,741. Liberal leave on full pay. Free passages for officer and wife by sea or air. Quarters at low rent. Income tax at low local rate. Children's allowances whilst separated.

Candidates should write for application forms and further particulars stating age, qualifications and experience, to the Appointments Secretary, Federal Public Service Commission, Nigeria House, 9 Northumberland Avenue, W.C.2, quoting Q.2/7.

WESTERN SELECTION AND DEVELOPMENT GROUP

Registered Offices: 120 Moorgate, E.C.2

Extracts from Mining Companies' Directors' Reports for Quarter ended 30th June, 1960

ARISTON GOLD MINES (1929) LTD.

Authorised Capital £1,500,000
Issued Capital £1,285,714
In 10,285,714 Units of Stock of 2/6 each.

OUTPUT AND PROFIT

Tons Milled	122,430	
Gold Produced—fine ozs.	38,157	
Recovery per ton—dwts.	6.233	
	£	Per Ton Milled s. d.
Working Revenue	474,063	77 5
Working Expenditure	334,620	54 8
(*a*) Working Profit	139,443	22 9

CAPITAL EXPENDITURE

Capital Expenditure during the Quarter amounted to £75,251.

DEVELOPMENT

A total of 6,022 feet of development was advanced during the Quarter, the total expenditure being £41,142.

NORTH OREBODY

Exploratory development on the 11th, 15th, 29th and 30th Levels continued during the Quarter.

No. 2 OREBODY

	Value Dwts.	Width Inches
11th Level		
No. 246 South Crosscut	7.5	70
No. 247 South Crosscut	5.2	36
No. 248 South Crosscut	3.6	63

This 11th Level Drive south from the Central Shaft has exposed between Nos. 244 and 248 South Crosscuts a pay zone averaging 7.8 dwts. over 62 inches for 305 feet.

	Value Dwts.	Width Inches
27th Level		
No. 215 South Crosscut	8.7	157
No. 216 South Crosscut	5.2	39

Results of the pay zones now fully exposed on this level are :—

	Value Dwts.	Width Inches	Distance Feet
Nos. 210 to 213 South Crosscut	5.9	124	220
Nos. 215 to 216 South Crosscut	8.0	99	77
TOTAL	6.3	117	297

	Value Dwts.	Width Inches
30th Level		
No. 210 North Crosscut	5.8	94
No. 211 North Crosscut	6.5	62
No. 212 North Crosscut	6.3	81

Footwall driving to the south is progressing as rapidly as possible.

WEST REEF

16th Level

Reef driving south of No. 201 North Crosscut has been restarted. A pay zone averaging 13.1 dwts. over 21 inches for a distance of 217 feet has been exposed, and driving south is continuing.

23rd Level

A pay zone averaging 8.5 dwts. over 56 inches has been exposed for a distance of 209 feet in the stope drive north and south of No. 251 North Crosscut. Stope driving south continues.

SOUTH OREBODY

	Value Dwts.	Width Inches
5th Level		
No. 288 South Crosscut	8.1	66

Stope driving continues on both the footwall and hanging-wall reefs.

SHAFT SINKING

No. 4 Winze—This Winze is now complete to the 27th Level and a connection with the main drive south from No. 2 Winze will be effected during the next quarter. Sinking is continuing.

Central Sub-Shaft—Work on the 29th and 30th Levels preparatory to the sinking of this Shaft is proceeding according to schedule.

Ankobra Shaft—The shaft is now 123 feet below the surface and No. 3 horizon is established. Sinking is in progress.

GENERAL

In accordance with the policy outlined to the Stockholders at the end of the 1959 financial year, development footage is being increased and during June, 1960, the figure of 2,403 feet was achieved.

AMALGAMATED BANKET AREAS LTD.

Authorised Capital £3,300,000
Issued Capital £2,884,900
In 19,232,669 Units of Stock of 3/- each.

OUTPUT AND PROFIT

Tons Milled	168,027	
Gold Produced—fine ozs.	38,077	
Recovery per ton—dwts.	4.532	
	£	Per Ton Milled s. d.
Working Revenue	474,307	56 6
Working Expenditure	423,316	50 5
(*a*) Working Profit	50,991	6 1

CAPITAL EXPENDITURE

Capital Expenditure during the Quarter amounted to £36,080.

DEVELOPMENT

A total of 8,550 feet of development was advanced during the Quarter, the total expenditure being £64,246.

	Footage Sampled	Footage Payable	Average Value
Akoon	4,485	2,315	6.4 dwts.
Mantraim	1,140	260	37.5 ins. 9.4 dwts.
Fanti	585	335	36 ins. 5.0 dwts.
Tamsoo	410	20	36 ins. 6.0 dwts.
Effuenta	75	75	36 ins. 4.3 dwts.
			36 ins.

BREMANG GOLD DREDGING CO., LTD.

Authorised Capital £1,250,000
Issued Capital £521,685
In 5,216,848 Units of Stock of 2s. each.

OUTPUT AND PROFIT

Cubic Yards Dredged	2,717,100	
Gold Produced—fine ozs.	16,908	
Recovery per Cubic Yard—Bullion—Grains	3.20	
	£	Per Cubic Yard Dredged d.
Operating Revenue	210,943	18.63
Operating Expenditure	127,730	11.28
Operating Profit	83,213	7.35

Capital Expenditure during the Quarter amounted to £10,538.

No. 1 Dredge was out of commission from the 20th June to 3rd July for major repairs.

GHANA MAIN REEF LTD.

Authorised Capital £1,500,000
Issued Capital £1,114,363
In 4,457,450 Units of Stock of 5/- each.

OUTPUT AND PROFIT

Tons Milled	33,283	
Gold Produced—fine ozs.	13,061	
Recovery per ton—dwts.	7.85	
	£	Per Ton Milled s. d.
Working Revenue	162,524	97 8
Working Expenditure	113,461	68 2
(*a*) Working Profit	49,063	29 6

CAPITAL EXPENDITURE

Capital Expenditure during the quarter amounted to £8,541.

DEVELOPMENT

A total of 2,356 feet of development was advanced during the Quarter, the total expenditure being £14,291.

MAIN SHAFT SECTION

Development Footage Sampled 850 feet.
Development Footage Payable, 210 feet.
Averaging 10.77 dwts. over 29.2 inches.

TUAPPIM SHAFT SECTION

Development Footage Sampled 480 feet.
Development Footage Payable 455 feet.
Averaging 12.23 dwts. over 56.2 inches.

(*a*) Excluding Development Redemption

CONSOLIDATED TIN SMELTERS

RESULTS EXCEED EXPECTATIONS

The thirty-first annual general meeting of Consolidated Tin Smelters, Ltd., will be held on September 8 in London.

The following is an extract from the statement by the chairman and managing director, **Mr. Clifford Waite,** circulated with the report and accounts :—

In view of the continuation of the control of exports of tin concentrates, the results for the year to March 31, 1960, were satisfactory, and the profits proved to be higher than I anticipated at the time of writing my statement last year. This was partly due to an increase in the tonnage of tin concentrates which we received for smelting, particularly at the Penang Works of Eastern Smelting Co. Ltd.; and partly to improved profits in certain of our ancillary businesses. Trading profits at £967,277 compare with £855,885 for the previous year. The final consolidated net profit for the year was £522,427, after tax, a satisfactory improvement in the circumstances over last year's figure of £396,301.

Your directors recommend an Ordinary dividend of the same amount as last year—that is, 3s. plus 6d. bonus, a total of 3s. 6d. per £1 unit of ordinary stock, less income tax.

During the entire twelve months fluctuations in the price were exceptionally small and the London Metal Exchange price remained throughout in the range £780 to £800 per ton. Since March of this year the position has been much the same, although at the present time the price of cash tin on the London Metal Exchange has increased to £810.

World consumption of tin in 1959 was higher than in any other year since the war, notwithstanding the longest strike in the history of the United States' steel industry, which began on July 15, 1959, and only ended on November 8, following a Federal Court order to return to work for an 80-day "cooling-off" period. Fortunately for tin producers the lower consumption in U.S.A. as a result of this strike was more than counter-balanced by increased consumption in the rest of the world, particularly in Western Germany.

Renewal of International Tin Agreement

The present Agreement expires on June 30, 1961, and an International Tin Conference held in New York approved a revised and final draft of a Second International Tin Agreement to run for five years from July 1, 1961, which will enter into force when instruments of ratification or acceptance have been deposited with Her Majesty's Government.

The present level of export quotas is practically tantamount to unrestricted production, so that provided it is possible to maintain a similar quota for the final quarter of 1960, the tonnage of tin concentrates to be treated at our smelting works should approach that received during the year to March 31, 1958. I therefore anticipate some increase in the Group's trading profits compared with those for the year under review.

PENKALEN LIMITED

MAJOR W. E. HOSKING'S STATEMENT

The fifty-second Annual General Meeting of Pengkalen, Limited, was held on August 10, at the Registered Office, Station Hill, Redruth.

Major W. E. Hosking, Chairman, presided.

The following is an extract from his Statement circulated with the Report and Accounts :

The Accounts for the financial year ended September 30, 1959, show a profit of £16,346 after payment to the Malayan Government of £21,445 for Royalty on Ore Sales, the provision of £13,250 for United Kingdom and Malayan Taxation, the writing off £3,871 for Capital Expenditure, and a refund of Expenditure relating to previous years of £549, leaving a balance unappropriated at September 30, 1959, of £62,035.

Dividends paid, amounting to 6d. per share, absorbed a net amount of £17,150.

Shareholders will note that, in the Balance Sheet, an amount has been set aside against Buffer Stock Contributions by transferring from General Reserve £27,409 representing contributions to September 30, 1958, and by a charge in the Profit and Loss Acount of £9,350 being the contributions during the year 1958/59.

As explained in the Chairman's Statement on the 1957 Accounts the Buffer Stock represents an asset frozen until the liquidation thereof and for this reason an amount equivalent to the contributions paid has been set aside in the Balance Sheet. This treatment will obviate certain taxation difficulties which would otherwise arise under the special legislation relating to Overseas Trade Corporations.

A total of 1,661,800 cubic yards of ground was treated for a yield of 332.10 tons of tin-ore, giving a recovery of 0.45 lb. per cubic yard.

Since the close of the financial year, shareholders have been advised of the sale of tin-ore as follows: October 1, 1959, to December 31, 1959, 85 tons, January 1, 1960, to March 31, 1960, 105½ tons, April 1, 1960, to June 30, 1960, 103¾ tons.

According to plan, the dredge was shut down and docked in February of the current year, for the re-plating of the pontoon and the installation of a new bucket band. The work was completed and the dredge resumed operations on May 31, 1960. During the shut-down period the Company's permissible sales were filled from accumulated stocks of tin-ore.

Throughout the whole of the year under review your Company's operations have been subject to the provisions of the Malayan Tin Control Regulations and the Company's quota has varied between 42.93% and 51.56% of its assessment based on the average annual production during the years 1953/57. In addition, quota was made available from within the Group under the same General Management on a profit sharing basis and allocations were also received from the Common Surrender Pool, under the Tin Control Regulations. Since the end of the financial year there have been progressive increases in the rates of quota and the rate for the quarter ended June 30 was 81.41%.

The Company's revised assessment, under the general revision of the assessments of all the individual Malayan Mines, which came into force on July 1, 1960, is 5,883 piculs per annum. This new assessment is based on the Company's rate of production while operating during the years 1958/59 which was abnormally low because of the shallow ground through which the dredge was passing. It is hoped to establish a higher rate of production during the current year.

International Tin Agreement

The 1960 World Conference on Tin has recently been in session at the United Nations in New York, at which a Malayan Delegation, comprised of Government Officials and representatives of the Malayan Mining Industry, participated.

It is now known that a new Tin Agreement has been approved at the Conference which, provided it is ratified by at least 15 member countries, of which not less than 9 must be consumers, will operate for five years from July 1, 1961.

It is reported that the Buffer Stock will be fixed at the equivalent in metal and cash of a maximum of 20,000 tons instead of at 25,000 tons as in the present Agreement, and that the new Agreement will follow the existing one in providing that export controls are to continue only when the Buffer Stock contains at least 10,000 tons of metal.

Unfortunately, both the United States and Russia will continue to remain outside the Agreement, but it is to be hoped that the first named country will continue its present "benevolent" policy and that Russia will agree to a very substantial limit to her exports.

It is reported that Japan and Western Germany who were not signatories to the present Agreement, have decided to join the new one.

The report and accounts were adopted.

Board Changes

Mr. John W. Price has been appointed to the board of Ex-Lands Nigeria. He replaces Mr. R. B. Woakes, who has resigned from the board.

★

Mr. J. A. Griffiths, F.C.A., has been appointed an additional director of Amalgamated Banket Areas, and Mr. S. H. Robinson has been appointed as an alternate director to Mr. C. J. Burns.

★

San Francisco Mines of Mexico announce that at a board meeting held on August 8, Mr. R. H. MacWilliam was appointed chairman and Mr. M. H. Spieler a director of the Company.

★

Mr. G. W.Parkinson has been appointed a full director, under Article 88, of Sir Lindsay Parkinson & Co. Mr. J. H. Bryant has been appointed a specialist director, under Article 95(A).

Wanted ENGINEER FOR COAL MINING ORGANIZATION in India under British management, to take Charge, in the first place, of group of collieries. Candidates if found suitable in the course of time have an opportunity of promotion to higher posts. Qualifications: Degree in electrical or mechanical engineering. Age: 30/35 years. Box No. 3588, c/o Charles Barker and Sons Limited, Gateway House, London, E.C.4.

RHODESIAN SELECTION TRUST GROUP OF COMPANIES

GEOLOGIST with from three to seven years' experience required for field mineral exploration in the Federation. Commencing salary £1,500 to £2,000 per annum depending upon qualifications and experience. Six weeks' leave per annum with accumulation up to eighteen weeks. Field allowance, bonus, share purchase plan, pension and medical schemes. Applications in the first instance to the Personnel Officer, Rhodesian Selection Trust Limited, P.O. Box 1479, Salisbury, Southern Rhodesia.

RHODESIAN SELECTION TRUST GROUP OF COMPANIES

GEOLOGIST — GEOCHEMIST required for field mineral exploration in the Bechuanaland Protectorate. Limited field experience acceptable but important that applicant should be fully conversant with wet method geochemical analytical techniques. Commencing salary according to qualifications and experience. Six weeks' leave per annum with accumulation up to eighteen weeks. Field allowance, bonus, share purchase plan, pension and medical schemes. Applications in the first instance to the Personnel Officer, Rhodesian Selection Trust Limited, P.O. Box 1479, Salisbury, Southern Rhodesia.

DAVIES INVESTMENTS LTD.

BANKERS

(Gross Assets £2,000,000)

are paying 7½% p.a. interest on deposits for the seventh year in succession, with extra ½% added annually on each £500 unit.

Details and Audited Balance Sheet from

Investment Dept. MN, DAVIES INVESTMENTS LTD DANES INN HOUSE, 265 STRAND, LONDON W.C.2

Rand and Orange Free State Returns for July

GOLD OUTPUT AND PROFIT

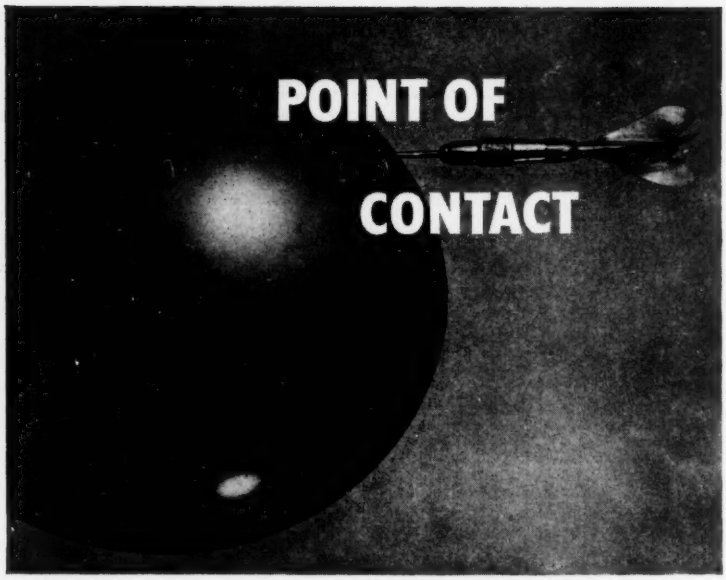
Company	July 1960 Tons (000)	July 1960 Yield (oz.)	July 1960 Profit† (£000)	Year ends	Current Financial Year Total to date Tons (000)	Current Financial Year Total to date Yield (oz.)	Current Financial Year Total to date Profit† (£000)	Last Financial Year Total to date Tons (000)	Last Financial Year Total to date Yield (oz.)	Last Financial Year Total to date Profit† (£000)
Gold Fields										
Doornfontein	105	42,620	216·7	J	105	42,620	216·7	94	38,102	186·5
Libanon	117	27,910	67·2	J	117	27,910	67·2	107	25,115	58·6
Luipaards Vlei	68	11,989	3·7	J	68	11,989	3·7	73	12,761	5·9
Rietfontein	15	4,060	5·0	D	110	29,098	43·4	112	29,456	50·8
Robinson	44	10,155	5·0	D	314	68,867	L4·0	416	88,496	L69·1
Simmer & Jack	75	13,430	1·2	D	533	94,603	L46·6	610	114,414	L51·5
Sub Nigel	66	15,079	15·1	J	66	15,079	15·1	66	15,835	22·7
Venterspost	123	34,133	75·0	J	123	34,133	75·0	131	32,337	61·3
Vlakfontein	52	18,858	88·6	D	361	129,373	610·9	352	126,253	596·5
Vogels	85	18,330	20·0	D	600	129,003	143·4	646	145,112	267·2
West Drie	130	120,836	1072·8	J	130	120,836	1072·8	97	88,542	732·8
Anglo American										
Brakpan	146	17,539	13·4	D	998	120,803	86·2	166	116,765	76·6
Daggas	233	47,217	227·8	D	1,625	328,221	1595·8	1,675	338,572	1669·5
East Daggas	106	18,026	41·4	D	736	124,840	283·8	694	115,440	220·9
F. S. Geduld	96	82,641	663·3	S	940	808,211	6478·7	788	609,030	4499·7
President Brand	118	95,590	834·1	S	1,161	946,277	8308·6	1,028	801,790	6836·6
President Steyn	100	37,311	155·2	S	1,014	392,951	1769·2	982	380,702	1923·9
S. A. Lands	98	20,452	49·0	D	675	140,282	306·8	672	140,683	398·3
Springs	102	14,091	13·5	D	719	99,964	101·3	627	99,441	84·7
Vaal Reefs	105	47,251	247·6	D	684	307,577	1600·0	603	272,687	1443·1
Welkom	102	32,148	81·0	S	983	310,056	745·9	949	289,701	790·0
Western Holdings	157	104,436	860·2	S	1,464	969,284	7994·7	1,114	668,472	5111·4
West. Reefs. Ex.	144	40,611	136·0	D	980	276,254	922·3	888	231,854	678·3
Central Mining										
Blyvoor	133	86,519	649·4	J	133	86,519	649·4	135	85,735	641·5
City Deep	119	23,391	6·1	D	791	162,989	38·3	805	167,988	70·7
Cons. M.R.	62	12,028	5·5	J	62	12,028	5·5	110	19,997	9·2
Crown	207	34,971	9·8	D	1,399	236,459	41·1	1,547	245,339	80·7
D. Roodepoort	198	36,016	50·4	D	1,346	246,353	345·5	1,322	245,013	373·7
East Rand Prop.	234	53,515	73·0	D	1,545	382,509	595·8	1,554	401,244	847·6
Harmony	167	66,830	305·1	J	167	66,830	305·1	147	58,076	270·3
Modder East	125	12,834	1·2	J	125	12,834	1·2	150	13,865	3·3
Rose Deep	23	4,190	1·5	D	171	29,949	8·8	288	37,063	1·9
J.C.I.*										
Freddies Cons.	64	13,726	L30·9	D	417	93,170	L286·2	409	98,738	L259·5
Govt. G.M.A.	52	10,753	0·5	D	369	75,588	3·5	375	74,836	L14·1
Randfontein	28	5,821	3·1	D	168	32,966	21·7	244	42,485	63·6
Union Corporation										
East Geduld	129	37,440	230·5	D	927	272,314	1752·3	959	288,891	1940·8
Geduld Prop.	75	12,527	21·1	D	514	91,454	166·3	507	95,153	171·2
Grootvlei	219	45,443	232·1	D	1,505	313,380	1594·6	1,455	308,160	1567·2
Marievale	99	24,180	126·6	D	690	168,841	878·5	652	161,259	781·3
St. Helena	167	56,782	350·8	D	1,119	377,412	2324·9	1,030	309,724	1662·0
Van Dyk	75	11,821	6·2	D	510	84,803	63·3	532	99,934	185·6
Winkelhaak	93	30,225	157·6	D	593	185,877	866·0	517	126,855	242·4
General Mining										
Buffelsfontein	148	60,273	326·0	J	148	60,273	326·0	144	54,521	284·4
Ellaton	29	6,847	24·9	D	200	47,360	176·2	218	51,013	206·6
S. Roodepoort	30	7,213	22·8	J	30	7,213	22·8	31	7,295	23·6
Stilfontein	168	75,936	409·3	D	1,118	503,866	2638·9	965	473,240	2898·8
W. Rand Cons.	140	20,069	13·4	D	923	132,139	48·0	952	138,453	129·8
Anglo Transvaal										
Hartebeestfontein	120	55,796	317·4	J	120	55,796	317·4	88	47,520	312·2
Loraine	81	17,217	L15·7	S	783	163,724	L195·0	763	149,066	L189·9
N. Klerksdorp	11	1,042	L7·3	D	78	8,423	L42·0	71	7,698	L63·1
Rand Leases	192	28,032	14·6	J	192	28,032	14·6	198	29,007	26·9
Village M.R.	32	4,720	0·8	J	32	4,720	0·8	28	4,626	1·0
Virginia O.F.S.	136	28,579	7·0	J	136	28,579	7·0	134	31,155	13·3
Others										
N. Kleinfontein	77	9,891	L3·0	D	546	70,742	3·3	579	75,087	21·6
Wit. Nigel	20	4,430	5·1	J	20	4,430	5·1	18	4,385	5·1

Gold has been valued at 249s. 5d. per oz. fine (June 249s. 11d.). L indicates loss. † Working Profit. *Working Profit includes sundry revenue. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Luipaards Vlei, Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year ends	July Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)	Company	Year ends	July Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)
Goldfields					**J.C.I.**				
Doornfontein	J	15·0	15·0	14·0	E. Champ d'Or (*b*)	D	6·2*	48·5*	47·0*
Luipaards Vlei (*a*)	J	90·0	90·0	92·0	Freddies Cons.	D	31·0*	212·0*	241·0*
Vogels	D	53·0	381·0	363·0	Govt. G.M.A.	D	23·0*	161·3*	154·3*
West Drie	J	49·0	49·0	50·0	Randfontein (*a*)	D	95·5*	749·0*	742·8*
Anglo American					**General Mining**				
Daggafontein	D	141·7	990·7	967·4	Buffelsfontein	J	212·0	212·0	213·0
P. Brand	S	44·1	461·6	458·7	Ellaton	D	16·0	122·0	129·0
P. Steyn	S	62·5	615·2	598·9	Stilfontein	D	88·0	626·0	602·0
Vaal Reefs	D	137·5	994·5	988·5	W. Rand Cons.(*a*)	D	205·6	1465·8	1398·8
Welkom	S	59·2	586·4	568·8	**Anglo Transvaal**				
West Reefs Ex.	D	162·0	1139·6	1107·7	Hartebeestfontein	J	250·0	250·0	267·6
Central Mining					Loraine	S	33·0	348·0	345·0
Blyvoor	J	163·0	163·0	153·4	N. Klerksdorp	D	11·0	74·5	76·5
Harmony	J	248·9	248·9	206·0	Virginia O.F.S.	J	176·2	176·2	177·2

Table includes profit from uranium acid and pyrite before loan redemption. (*a*) Total profit from uranium section. (*b*) Overall profit. *Net revenue after provision for loan redemption.



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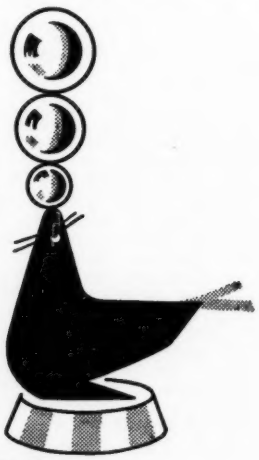

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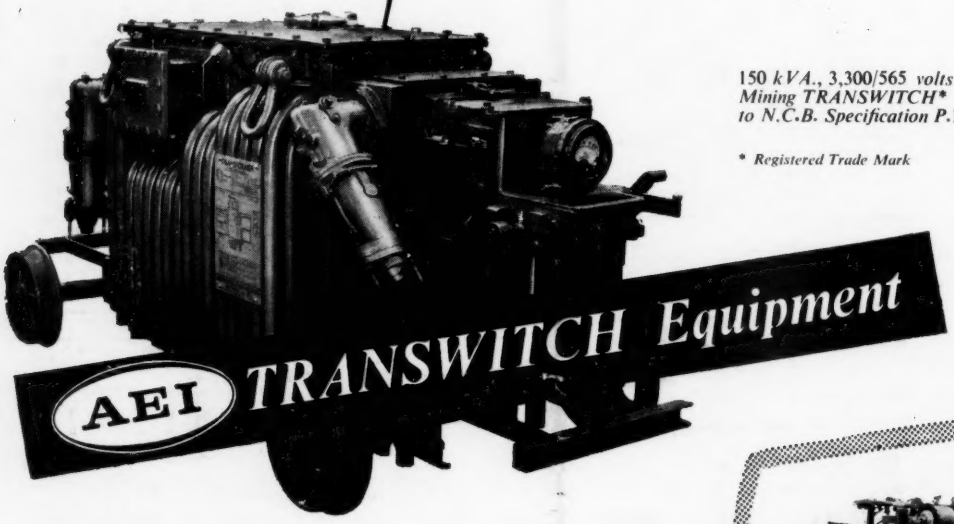

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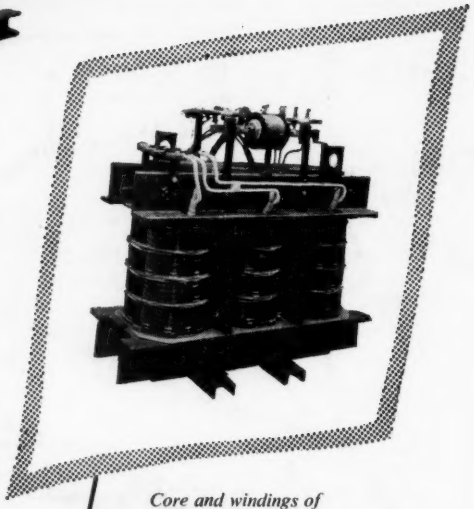

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